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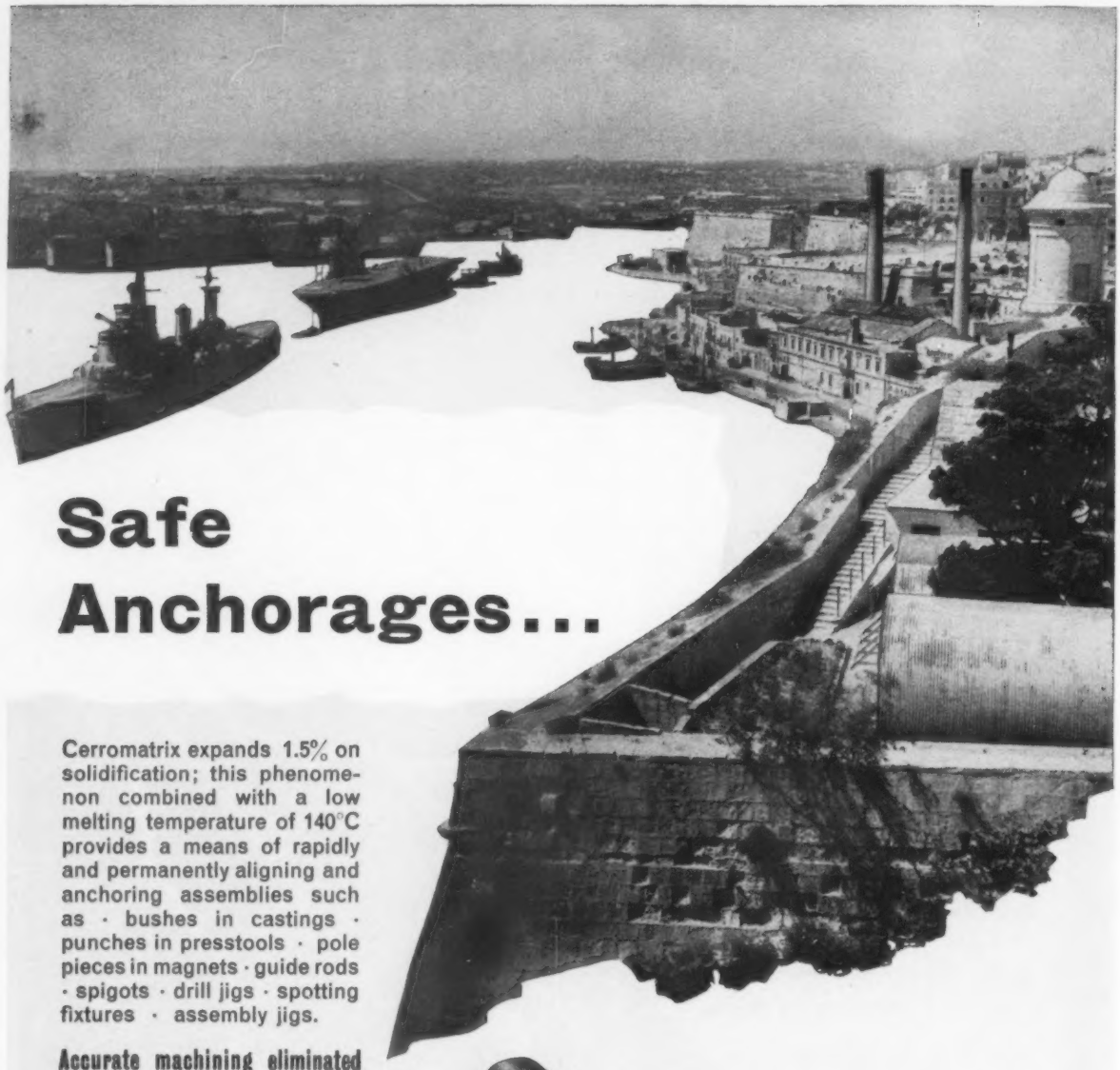
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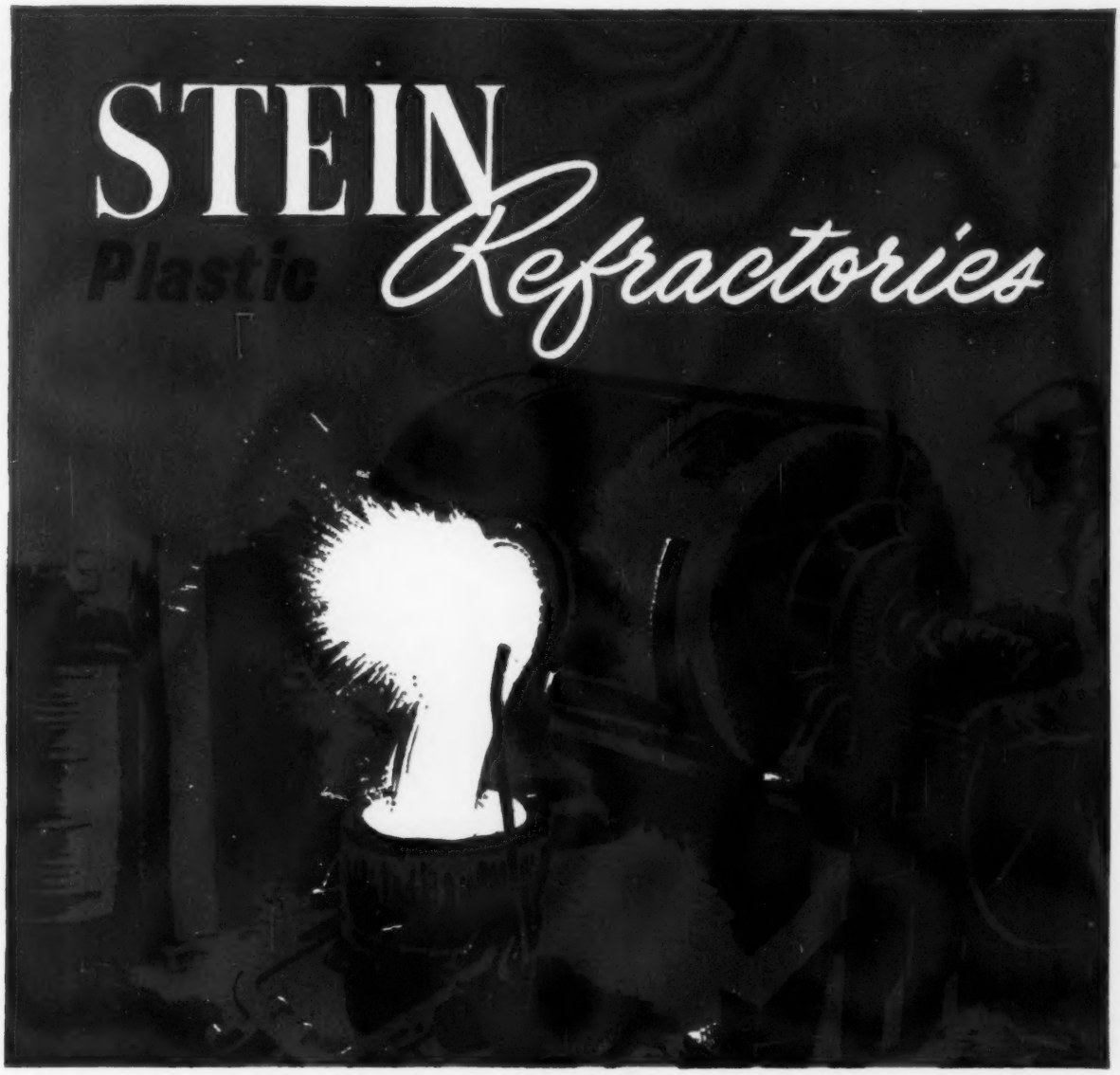


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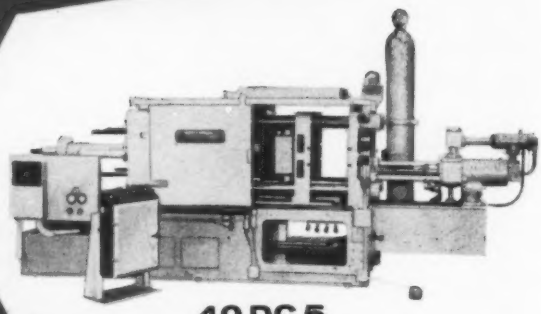
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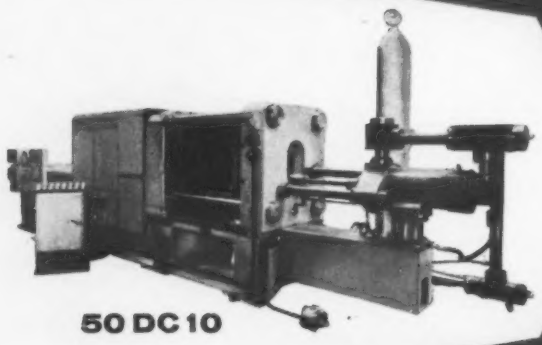
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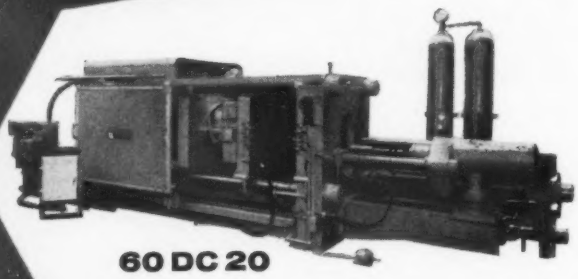
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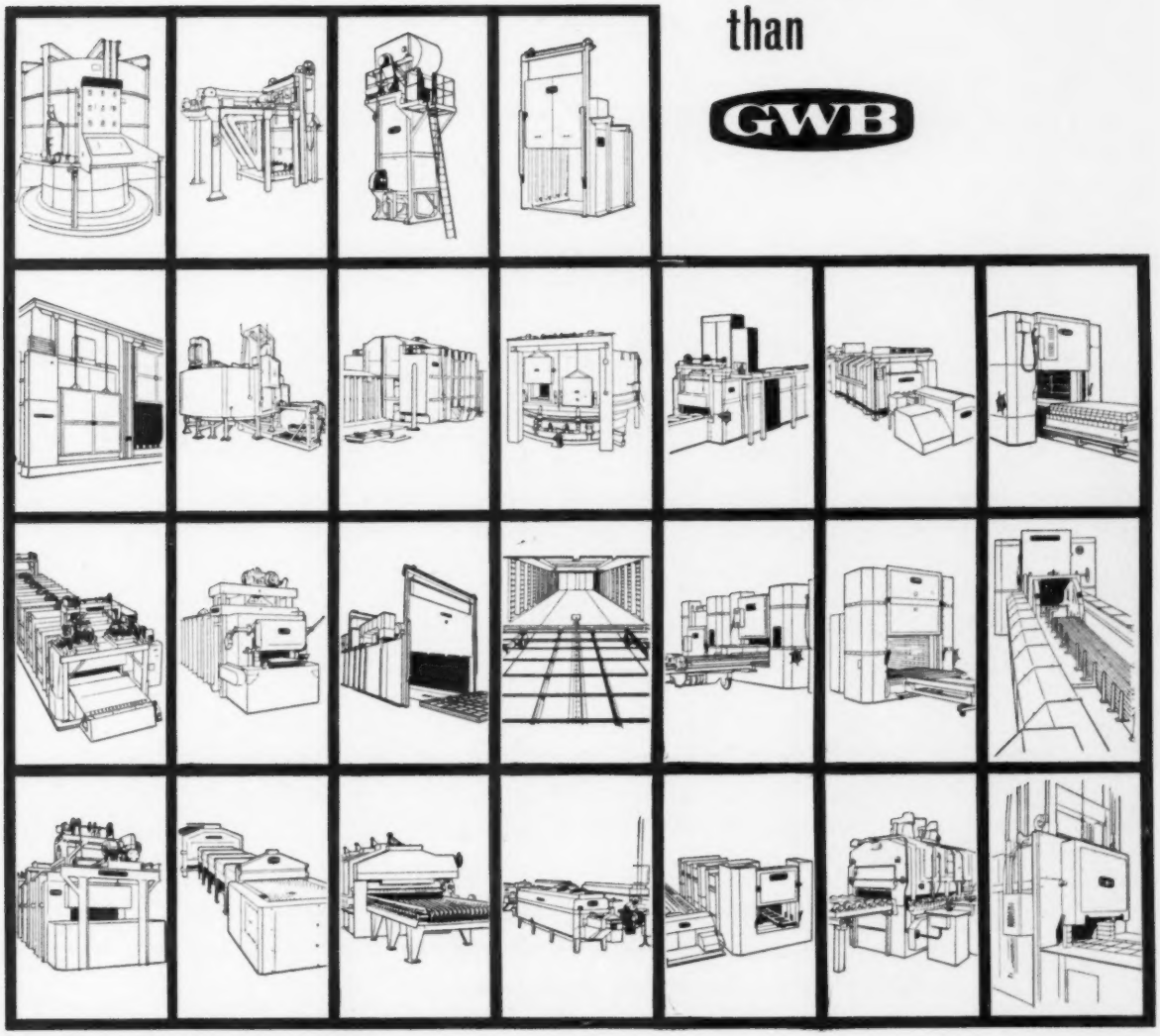


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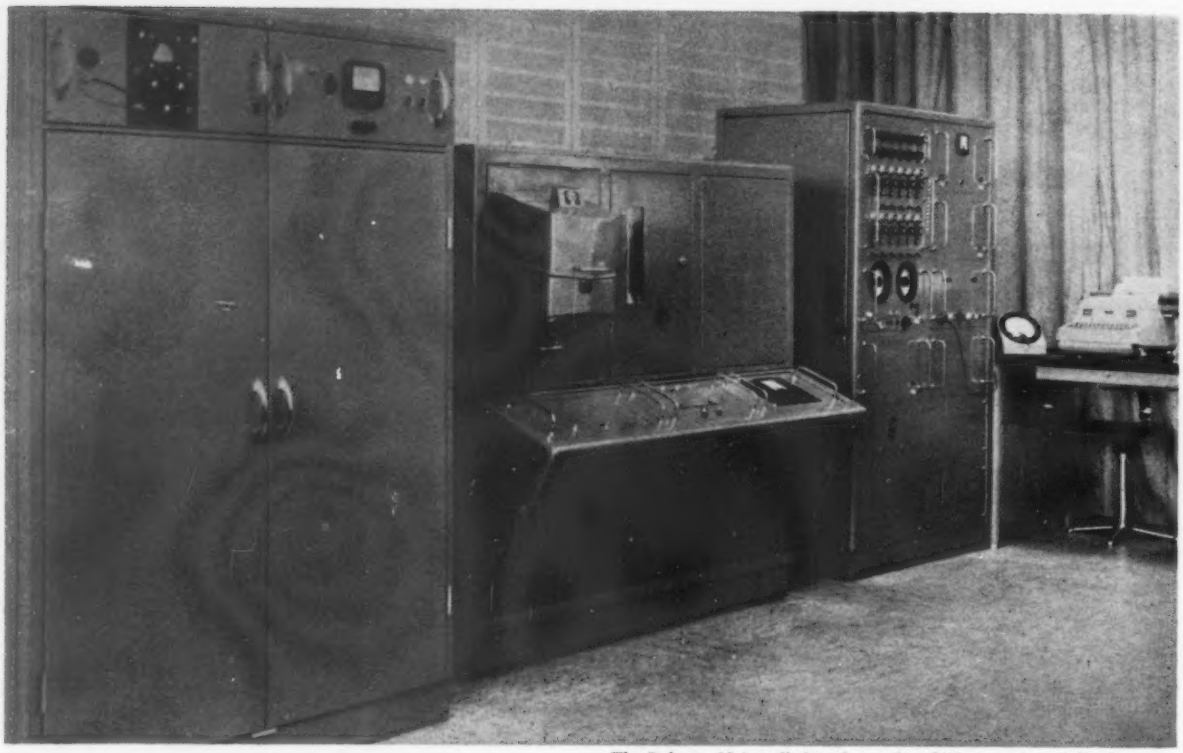
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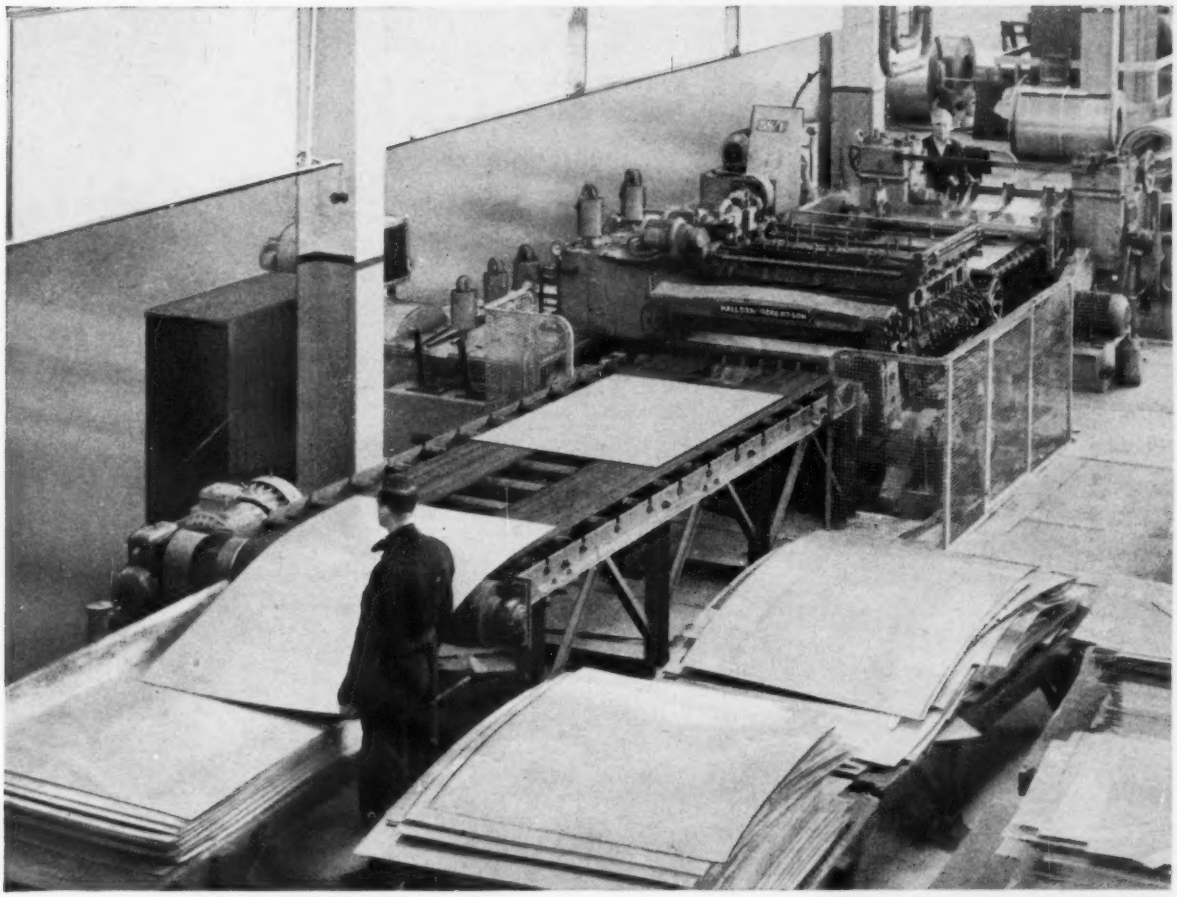
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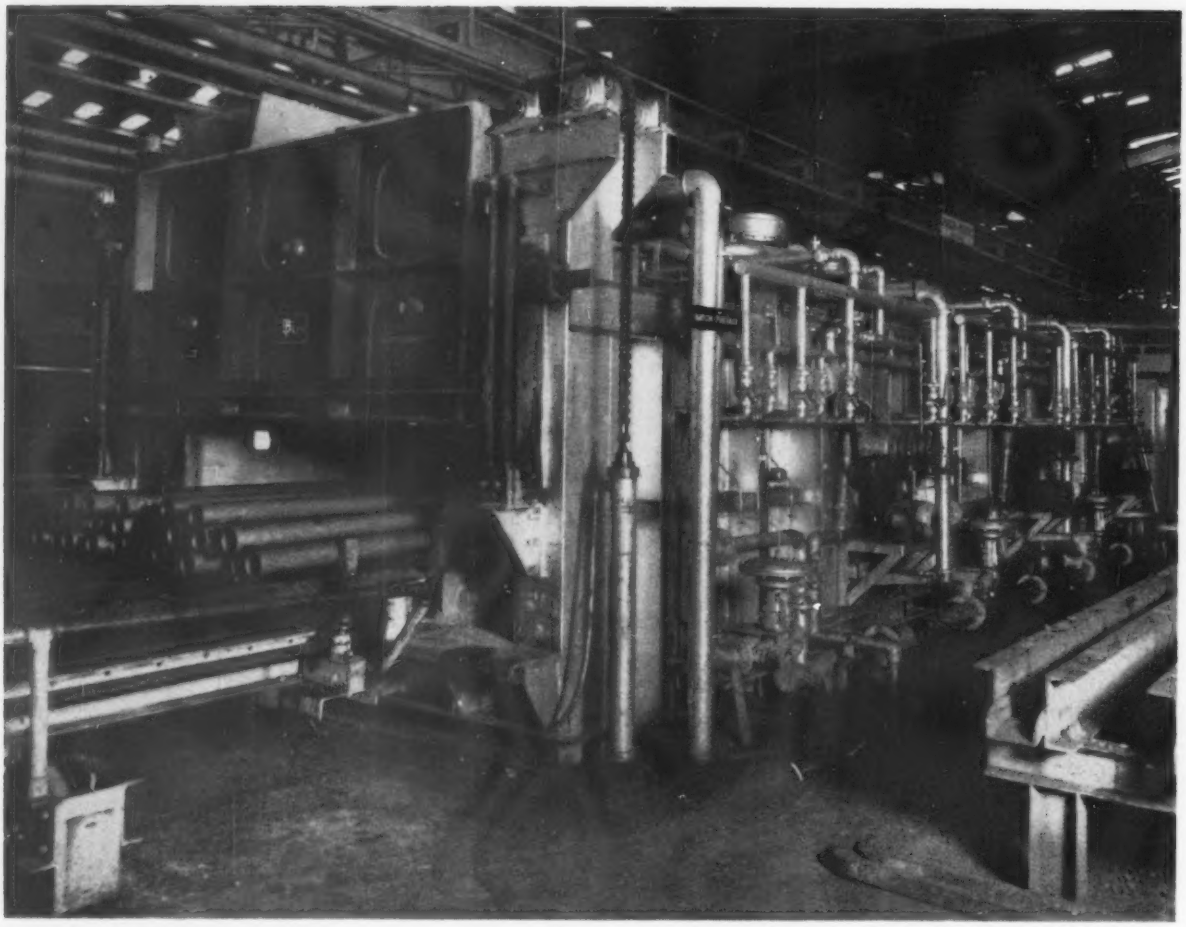
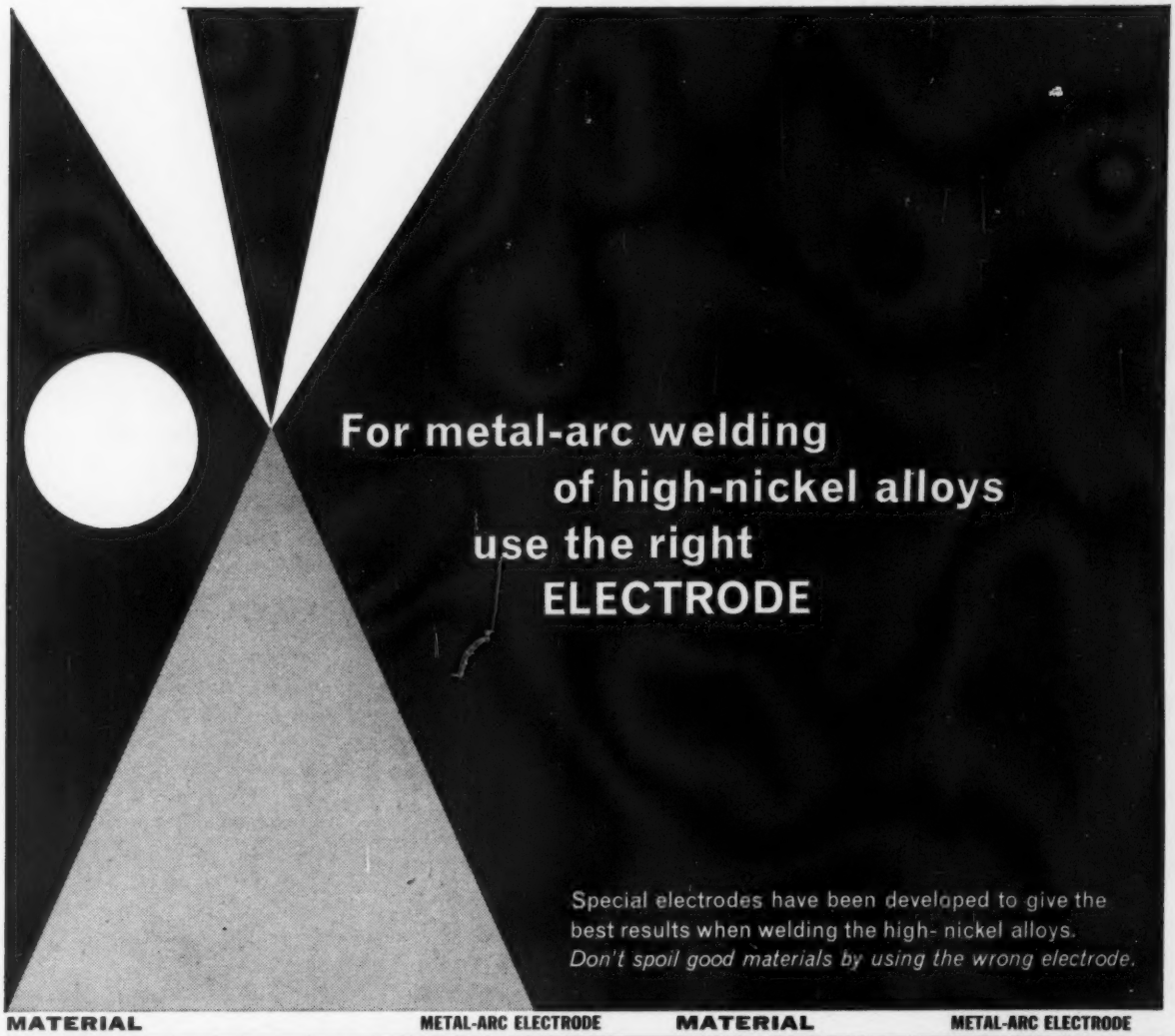


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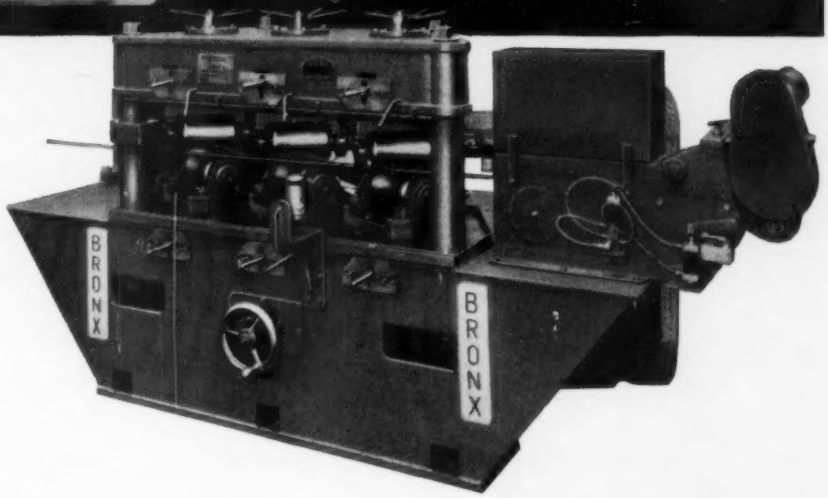
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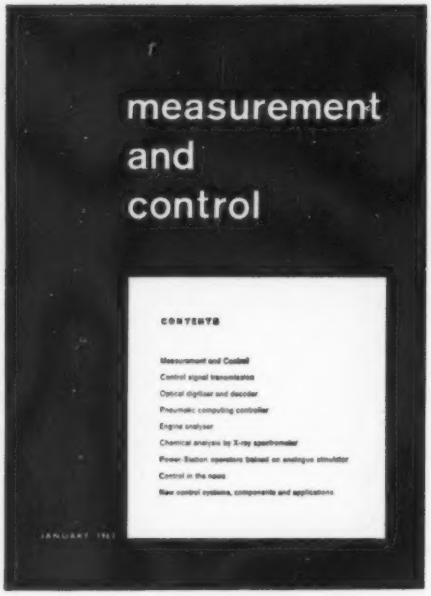
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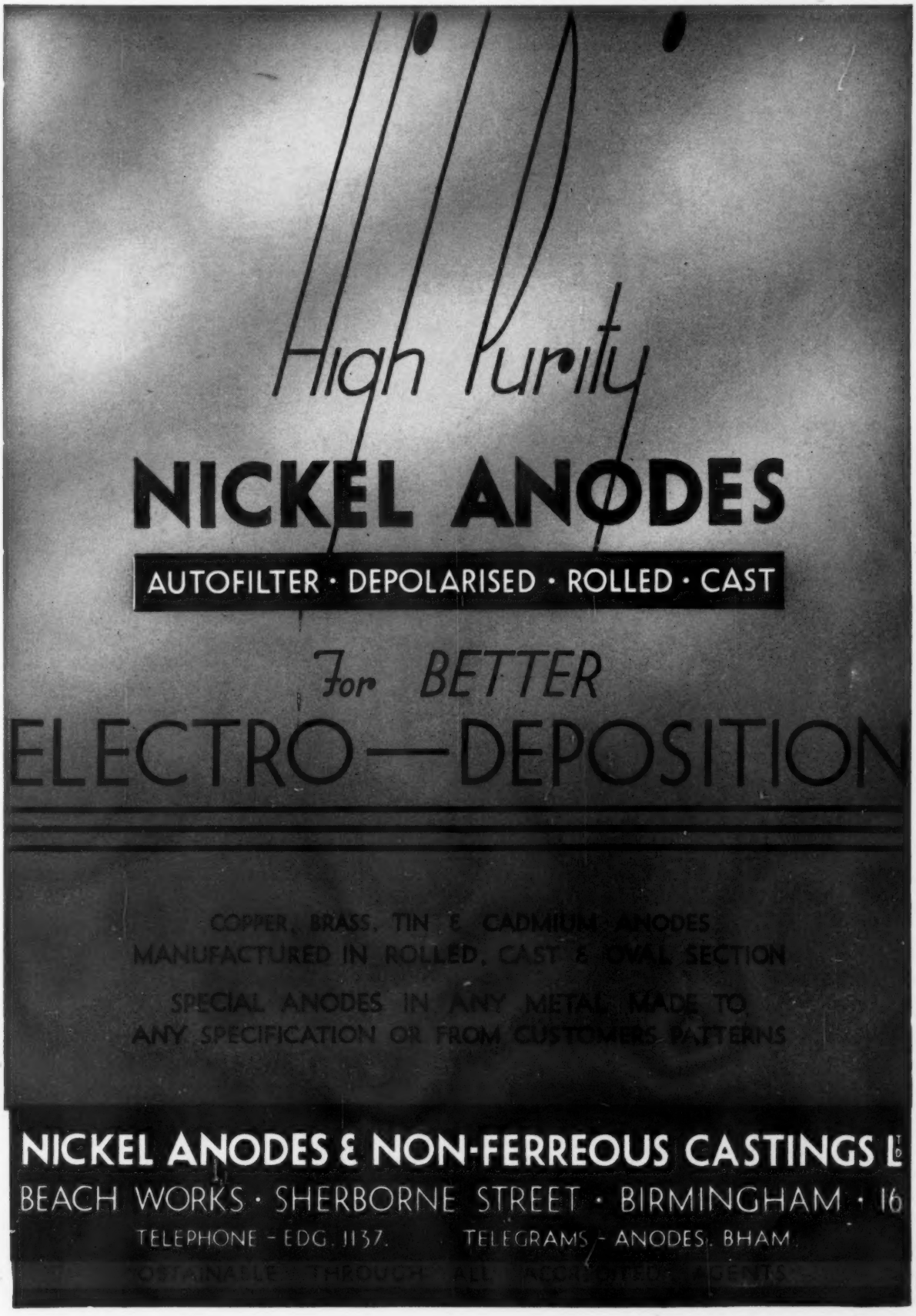
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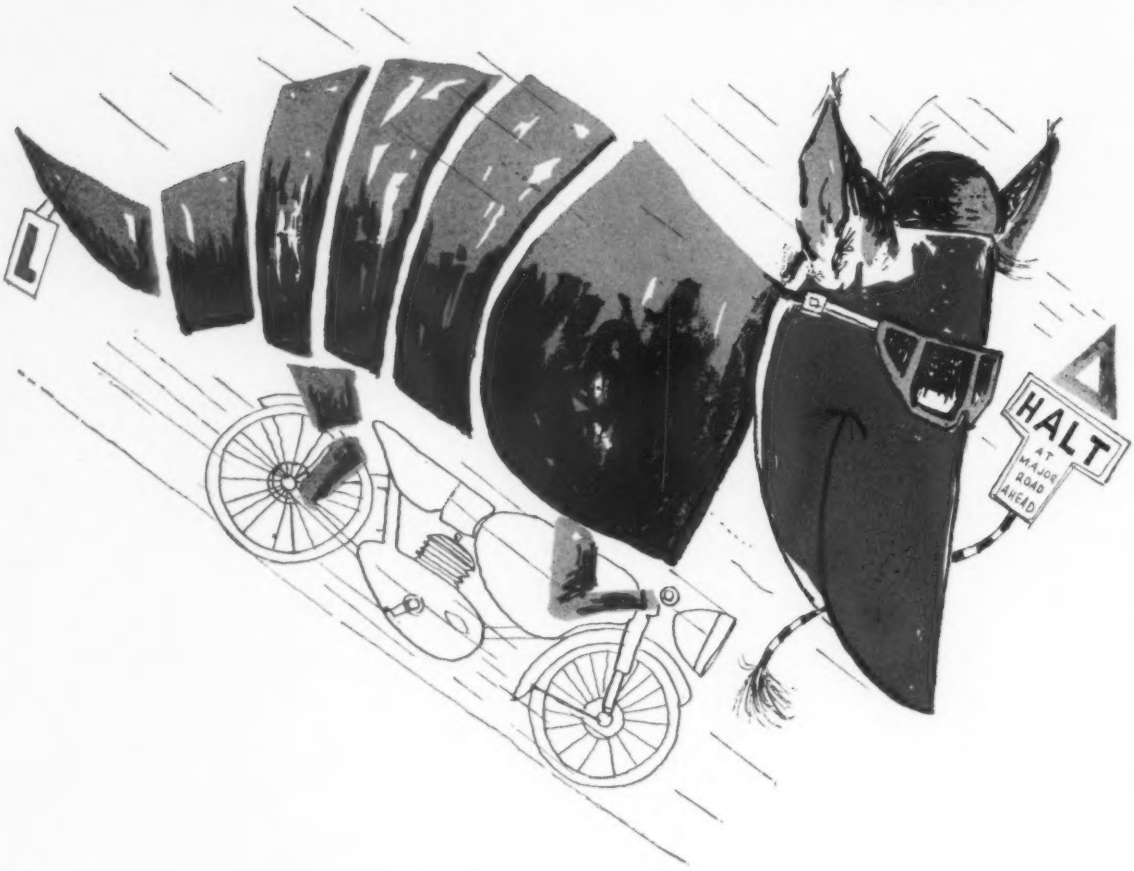
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FOUNDED 1909

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METAL INDUSTRY

3 NOVEMBER 1961

VOLUMER 99

NUMBER 18

A Bad Year

ON any analysis 190,000 accidents represent a heavy toll of human and economic losses, and 1960 must go down as a bad year for industrial safety. Thus does H.M. Chief Inspector of Factories, in his annual report, sum up the increase in accidents reported to the Factory Inspectorate last year. In point of fact the 1960 total of accidents, with an increase of 9 per cent over the previous year, was the highest for ten years. Accidents in factories numbered 161,524 and were the highest since 1955. On the other hand, fatal accidents in factories have shown an almost continuous decrease since the war and the 1960 total of 354 deaths was only four more than the record low figure in 1959. This reduction in recent years is undoubtedly due in part to improved techniques in manufacturing processes lessening the risks and to advances in medical arrangements.

One of the most serious features in the report is the big increase in accidents to young persons, an increase of 15 per cent, machinery in motion being one of the major causes. Similarly, accidents to women increased proportionally more than those to men, the incidence rates for manufacturing industries revealing a rise of 4 per cent in accidents to males compared with 9 per cent for females. "Both women and young persons", the report says, "present industry with a similar challenge—the challenge of the new entrant. . . . Only careful and skilfully planned training which takes account of individual needs and capacities can ensure that the new entrant learns to avoid the pitfalls of industrial life, and to work in the way that is safest for himself and his fellows."

Handling was again responsible for more factory accidents (more than one-quarter of those reported) than any other single cause. One remedy, it is suggested, is a wider use of mechanical handling. Injuries to the eyes totalled 7,093, of which 4,072 were in metal manufacture and engineering. The use of eye protection would have prevented many of the irreparable losses caused. Attention is also drawn to the fire hazards arising from the use of highly flammable solvents in such varied processes as powder metallurgy and electrostatic paint spraying.

Two factors may be cited as probable causes of the increase. First, the average number of workers subject to the Factories Act increased in 1960 by a little more than 4 per cent; for young persons it averaged between 9 and 10 per cent. Secondly, there was an increase of 8 per cent in the Index of Industrial Production. But if these increases in employment and activity, desirable as they are, help to explain what happened, they do not excuse it. It must be recognized that safety is primarily a matter for employers, and for the workers themselves. Hazards vary from industry to industry and it is for the responsible people in each industry to study their particular problems and work out plans to overcome them. If the figures of industrial accidents are to be brought down, as, of course, they must, a united effort is needed on the part of all concerned. All in industry must become more safety-minded.

Die Design for Pressure Die-Casting

By W. M. Simpson and R. P. Bryan
(*Metal Castings Doehler Ltd.*)

MANY factors affect the design of a die for the production of pressure die-castings, but generally speaking the following group covers the main aspects which must be considered initially: (1) size of component; (2) number of components to be manufactured; (3) casting machines available; (4) material from which component is to be manufactured; (5) complexity of shape; (6) finish required.

Each one of these factors will affect the design of the die in varying degrees, and they are usually connected in such a way that very often any one of them may have an overriding effect on the others. Each of these factors may be considered briefly, as follows.

The size of the component will determine the size of the cavity, and the number of cavities will control the size of the die. The limiting factors in this respect will be the range of die-casting machinery which is available and the number of castings required.

The number of components required and the period in which they are to be supplied will be an important factor in deciding how many cavities are to be made in one die. The factors which limit the number of cavities are the casting machines available and the combination of die size and machine which will give the most economic production.

The range of casting machinery available will obviously have a limiting effect on the size of the die. There are two factors which control machine selection, namely size of die which has to be housed and area of cast surface in the die, which must be such that sufficient injection pressure can be applied to it to give a satisfactory result without overcoming the locking force of the machine. It is on this latter point that many die designers tend to miscalculate or not allow a sufficient margin of safety in selecting the machine to be used. This is usually done, however, so that the smallest possible machine can be used and a correspondingly high production rate obtained to produce the component, in theory, at the most economical level. If the machine does become overloaded, however, by the addition of pockets or alterations to the runner system, the scrap figures may be such that it would, in fact, be cheaper to use a larger machine although the rate of production would be slower.

Locking force, however, is not the only criterion in machine selection, as is the case when the locking force required is small but the volume of the cavity comparatively large. In this case the controlling factor would be the injection capacity of the machine. With the cold chamber type of machine, it is simply a case of selecting a plunger diameter which will inject the required volume of metal at the required pressure.

On hot chamber machines, the volume of metal which can be injected for a given plunger diameter, is usually covered by a chart which gives this information for the range of plunger diameter which can be accommodated on any one machine. It has been found in practice, however, that the figures quoted are usually in excess of those which can, in fact, be obtained under normal operating conditions. The designer must, therefore, be aware of this limitation when plunger diameter is selected.

The material from which the component is to be made will determine the type of die which is to be manufactured, i.e. hot or cold chamber, and will have an effect not only on the shape of the die but also on the steel from which the die is made and the method of heat-treatment which is to be applied.

The alloy will also affect the method of obtaining thermal balance in the die, as the temperature of the molten metal will vary from one alloy to another.

When a casting is of such a shape that it cannot be formed simply by the two halves of the die, the use of slides must be incorporated, which may affect the number of cavities which can be included in the die. The designer must also give greater consideration to gating, venting and ejection facilities when the form of the casting is such that conventional techniques cannot be readily applied.

When the standard of finish required on the casting is an important factor, the die designer must ensure that joint lines, ejector pins and pockets, etc., are positioned so that they do not detract from the appearance of the finished article. The surface finish of the die must also be of a higher quality than can be obtained simply by machining. When uniformity of finish from one casting to the next is required, it is often advisable to limit the number of cavities so that a uniform runner system can be employed.

Each of these factors, although elementary, must be considered during the estimating stage of the process, and it will be the decisions made at this time which will, to a very large extent, affect the ultimate efficiency of the die.

It is not intended here to cover every detail of die design and manufacture, however, and it is thought that in this instance it would be of greater value and interest to discuss in some detail those aspects in which there has been development during recent years and also those points on which there is more than one school of thought.

Retaining Slides

During recent years, the method of retaining a slide in a die block has been of the form shown in Fig. 1. The manufacture of this type of fitting does, however, involve a considerable amount of machining, especially in the die block, where a Woodruff cutter has to be used to form the retaining housing for the slide. Consideration of this problem has shown that there are a number of ways in which this machining can be reduced and, at the same time, greater accuracy obtained. The initial objective is to eliminate the machining of the undercut, which will necessitate the provision of a different retaining fixture. This can be done in a number of ways, one of which is shown in Fig. 2.

From the machining angle, this represents a big improvement and also facilitates easy removal of the slide from the die simply by removing the wear plates. It does, however, have one major disadvantage, this being that the upper slide face is in line with the die face and is likely to fill with metal should the die start to blow. This cannot be completely overcome, but a big improvement is effected if either of the constructions shown in Figs. 3 and 4 is used.

The method shown in Fig. 3 still involves a fair amount of machining, although it is relatively simple, and it is, therefore, thought that the construction shown in Fig. 4 is probably the best, although both of these function satisfactorily.

Die Block Manufacture

A large proportion of the cost of a die is taken up by the die blocks. Much

So many factors affect the die designer in his choice of materials, of methods of construction, of placing of cavities, gates and runners, and of die temperature control techniques, it follows that every designer's selection is largely an individual one. With the object of sharing experience and ideas on die design for gravity and pressure dies, the Light Metal Founders Association recently held a Symposium on die design at which this Paper, dealing with pressure die design, was presented

of this expenditure is involved in the cost of the material, especially in large blocks, but a big part is due to the cost of machining the blocks to the required shape.

This is inevitable when the blocks are made from forgings or mild steel, as they are supplied in a uniform rectangular shape, and all the form required is obtained by machining operations. A method of overcoming this is to use blocks made from high quality cast iron, which can be cast to the shape required. This will reduce machining to a minimum, as the pattern can be made to leave only a machining allowance on each face. There are disadvantages with this type of construction, however, in as much that a pattern is required for each block, which will tend to affect the savings made by reduced machining and, therefor, this type of construction will not be economic in every case. A further disadvantage, but this time only of a minor nature, is that it is difficult to weld brackets, etc., to the sides of a block made in this material. The fears that a block of this type will not withstand the stresses which are applied to it are justified to a certain extent when the loading is other than compressive but this can be overcome by taking the appropriate safety precautions at the design stage.

Cast steel, which is often used for die blocks, can also be used without hardened steel inserts for the production of small quantities of castings which may be required for experimental purposes. The impression is machined directly into the cast steel block and is capable of producing satisfactory results for approximately 500 shots. The method of cooling a die of this type is to spray the face with steam, this having the effect of creating good heat transfer by virtue of the water deposit on the die face. Steam is used in preference to water, as it can be applied to a large area easily and quickly without excessive amounts being applied to one point.

Thermal Balance

Each casting and die has some optimum range of temperature at which the die would be operated to produce satisfactory castings. The surface temperature of the dies can be kept constant within small limits by regulating the operating cycle of the casting machine, thus maintaining a constant heat input.

Following the introduction recently of a new type of incentive bonus scheme at the writer's firm, the cycle time of many of the casting machines was decreasing, with the result that in a number of cases the cooling facilities for the dies were found to be inadequate. As a result of this, dies are now designed with more waterways than before in order that this increased rate of production is not jeopardized.

One of the snags found during operation of a die which has a number of water lines is that if the flow of water on any one line requires adjustment the operator has to go through the procedure of tracing that particular line back to the appropriate valve so that the adjustment can be made. A simple way in which this can be overcome is to paint each control valve a different colour and record this colour on a chart, showing which section of the die it supplies. By reference to this chart, the operator can make adjustments to the flow of water with the minimum of delay.

Split Die Inserts

A practice which is apparently being employed more and more at the present time is that of splitting die inserts into a number of small sections which are easily manufactured. The problems connected with this are numerous, however, a major one being the inability to maintain a satisfactory fit between the various segments during operation. The result of this failure is that as the die wears, metal begins to force its way between the mating face, leaving thin fins of alloy on the face of the casting.

The advantages of this type of construction are also numerous, however, but there is, nevertheless, a tendency to machine impression blocks from one piece of material whenever possible. Although this may be the obvious way in many cases, there are occasions when the designer goes out on a limb and hopes that the insert will not only be machined satisfactorily but also that it will not distort during heat-treatment.

It would appear, therefore, that in order to make this type of construction more attractive there must be some means of obtaining a fit between the various segments which will be retained, within reason, during the life of the die.

There are many different opinions on the way in which this can be done, but one that is in use and has proved successful over a considerable period is as practised by the Doehler-Jarvis Company of America.

This procedure is to machine the cavity in the holding blocks with a 1° taper on the walls so that an interference fit is obtained between this and the insert blocks. As a further means of obtaining the required fit, jacking screws are fitted into the holding blocks so that they contact the outside face of the insert at predetermined points. The holding block is then heated sufficiently to expand the insert cavity, the inserts are placed in position and slight pressure applied by the jacking screws so that upon cooling there exists an exceptionally good fit between the various segments of the insert. Should this fit deteriorate in any way during the operation of the die it can be rectified by adjustment of the jacking screws.

By following this procedure it

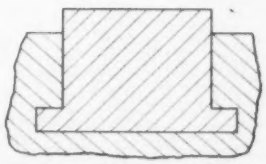


Fig. 1—Usual method of retaining a slide in a die-block

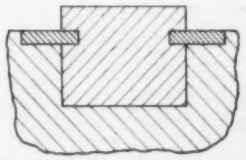


Fig. 2—Alternative method which eliminates the machining of the undercut

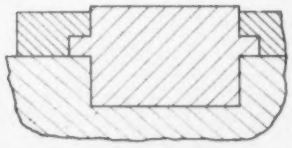


Fig. 3—An improved method of retaining a slide. With this construction there is less chance of molten metal fouling the slide as with that of Fig. 2

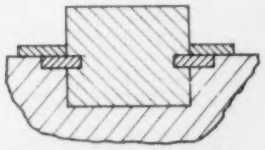


Fig. 4—Another method of retaining a slide which involves only simple machining but retains the benefits of the construction shown in Fig. 3

becomes relatively simple to remove the insert from the block and to replace any section which may be damaged, whereas with the normal solid block construction it would be necessary to fit a patch to a damaged section, a practice which does not usually meet with very much success. On large dies it has been found that erosion of the impression near to the gate can be overcome by making this section a separate piece and replacing it as wear becomes evident, thus reducing the length of time the die normally spends in the toolroom whilst efforts are made to rebuild the section with weld.

Cast-In Inserts

A practice which has been in operation for many years is that of casting inserts into the component during the casting operation.

On the face of it, this would appear to be an economic method of carrying out this operation. Experience has shown, however, that this is not the case, especially on die-castings which have to be chromium plated. It has been found that the difference in temperature between the stud and the die causes the casting to contract at a different rate around the stud, with the result that a sink or small depression is evident on the face of the cavity in the stud area. This cannot usually be removed during the subsequent polishing operation and thus the casting is rejected.

This problem can be partially overcome by heating the studs before they are placed in the die but if this practice is adopted it does tend to slow down the cycle time of the machine, with the result that every so often a "hardware" finish cannot be obtained due to the loss of heat in the die.

Although it means an extra operation, it is often more economic to fit the studs into the component during fettling.

Apart from affecting the finish of the components in zinc it has also been found that when studs are fitted into aluminium castings there is evidence of porosity which is not apparent when cast without studs. It is now the policy of the author's company to eliminate cast-in inserts whenever possible, for these reasons.

Transfer Coating

A project being developed by the Doehler-Jarvis Company of America at the present time is that of transfer coating. This is similar to a practice of casting inserts into a component but has many more advantages. By this process, a bore in a casting which is to house a shaft or some similar moving part can have deposited on its surface a thin skin of metal of the required type which will give a satisfactory bearing surface.

To do this, the core which is to form the bore in the casting is made as a loose piece so that it is removed with the casting during ejection.

Before this loose piece or mandrel is inserted into the die it is sprayed with metal to the required thickness. This is done by fitting the mandrel in a lathe and feeding the spraying equipment along it by means of the lathe saddle at a rate which is determined by the thickness of metal which is required.

The mandrel with the deposit of metal, which incidentally can be of almost any type, is then fitted into the die and the casting formed around it. As the mandrel is of hardened steel, there is little adhesion between it and the deposit but there is excellent adhesion between the deposited metal and the cast alloy. Consequently, removal of the mandrel is a simple matter. This process has many advantages, the foremost being the ability to deposit such a thin skin, thus keeping the weight of the component to a minimum, a factor which has obvious advantages in present day component design. The process also ensures that the dimensional summary of the bore is maintained within very close limits and also, by the nature of the application, gives a hard surface which does not require machining of any kind.

Undercuts, which would be expensive to machine into a normal bush, can also be accommodated simply by making the mandrel collapsible.

Heat-Treatment of Die Steels

A point which usually causes considerable discussion among die-casters is that regarding the heat-treatment of dies for the production of zinc castings. There are two ways in which this can be done: heat-treatment prior to machining and heat-treatment after machining.

In the first method, the impression block is machined from steel which has been hardened to between 200 and 300 B.H.N. The hardness that is specified depends upon the service required of the die and the amount of hand work required to make it. Hard material gives longer life but is more difficult to work by hand. Work done by power tools on steel having a hardness of 300 B.H.N. is not too difficult although it is considerably slower than the machining of a softer material. The advantages of manufacturing a die in this way are numerous but tend to be limited to certain dies. The main objective with this type of manufacture is that, as no heat-treatment is necessary after machining, the possibility of distortion or damage, such as cracking, is eliminated.

Apart from the obvious disadvantages of extra machining time involved by this method it has been found that a die of this type is more prone to damage during production. If, for example, flash is left on the die face and the machine closed, the die surface becomes bruised, and should this happen on the edge of the cavity there will be a tendency to form an undercut in the die which will hamper ejection, or will cause the component to remain in the fixed half of the die. Removal of this casting can itself tend to damage the die, especially if hand tools are used for this purpose. It is thought, therefore, that although this method of construction has many advantages it is not advisable to adopt its use in the majority of cases, the exception to this being dies for components which are of such a form that it is almost certain that heat-treatment after machining would be a precarious business.

A practice being adopted to a certain extent at the present time is that of heat-treating dies before sample castings are made; by this method allowances can be made for warpage and the various die sections ground to the desired fit. The object of this is simply to have the die ready for bulk production in a shorter time than with the conventional system of sampling the die in the soft state and then making any adjustments which may be requested by the customer before heat-treatment. Should adjustments be required, it would not be necessary in the majority of cases to soften the die as developments in the capabilities of cutting tools now make it possible to carry out any modifications with very little difficulty.

When dies are made from soft or relatively soft steel it is often found that, due to the amount of machining which is required, a certain degree of work-hardening occurs. To overcome this, it is the author's company's policy to anneal die steel as and when this is considered necessary, and this operation may, in fact, be carried out as many as four times during the construction of the die. Great care must be taken during the operation to ensure that the correct treatment is applied as it may be found that the steel does not respond in the anticipated manner to subsequent hardening.

Spark Erosion

Spark erosion is a relatively new technique of machining die impression inserts and although this process has many limitations it does enable the die designers to incorporate features in die design which would require a completely different approach if conventional machining methods only were available. An example of the type of work which would be very difficult to perform without spark erosion is an automobile grille for which the ejector die consists of a series of sharp-cornered rectangular cavities which were formed almost completely by spark erosion. To construct a die of this form by conventional methods would entail either a considerable amount of hand work or a completely different die construction, which would cost considerably more.

Apart from this type of application, spark erosion equipment is also most useful for modifying hardened dies. By this process, pockets, ejector pin holes, and runner adjustments can be made without very much difficulty.

This process cannot, however, be applied economically to the production

of every die cavity, due to the high cost which would be involved in manufacturing the anode, a job which may have to be repeated several times during the die construction.

It is, therefore, thought that although a spark erosion equipment is an obvious asset to any toolroom, it is not the type of plant which can be fully utilized during all working hours and is too expensive to be allowed to remain in operation for long periods.

Standardization of Die Parts

There are a number of sections in every die that are within limits common to one another. It is, therefore, surprising that so little headway has been made on the possibility of using standard parts.

Ejector pins are the most suitable components for this approach and, in fact, to a limited extent these can now be produced in standard diameters and the lengths adjusted by the purchaser to the particular dimension required.

Attempts are now being made to standardize sprue posts and whilst this is probably a more exhausting task than with ejector pins it is thought that there should not be much difficulty in overcoming the problems connected with the idea. But probably the biggest drawback to the standardization of sprue posts is that of length. It is thought, however, that if a reasonable range of standard sizes were available, any requirements between the standard sizes could be met by machining to the required length. To do this it would be necessary to limit the length of the waterways in the sprue post so that the removal of metal would not leave too thin a section, which might fail in operation. It might be argued that if a sprue post did not require this adjustment, then the waterway would be too remote to be effective. This would depend upon the difference between one standard size and the next, but in any case it is thought that the ultimate position of the waterway is, within limits, not too critical.

The third section of the die which could be standardized comprises the pilot pins and bushes; these sections are in many cases similar to those used in die sets which can be purchased readily for the construction of press tools.

The standardization of die bolsters is a project which was investigated some time ago but it was stated by the investigating body that so many sizes would be required that this was not a practical proposition. Although the ideal sizes required for each die would constitute a formidable range, there could be established a range of standard sizes which would be used, it is thought, to an extent which would justify the steel suppliers holding a stock. It appears to be a question of designers using the standard range whenever possible rather than attempting to formulate this range from those sizes now being used.

Multi-Cell Plating for Wheel Rims

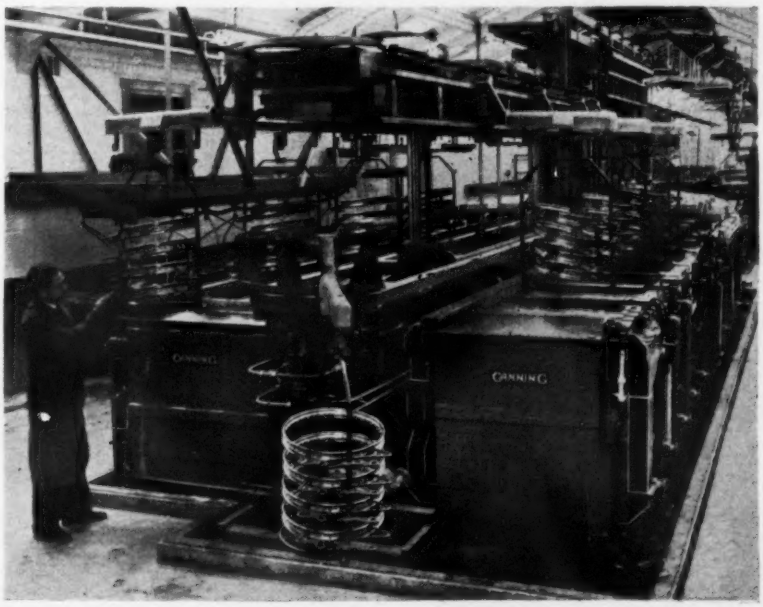
NOVEL PLANT INSTALLED AT TRIUMPH ENGINEERING LTD.

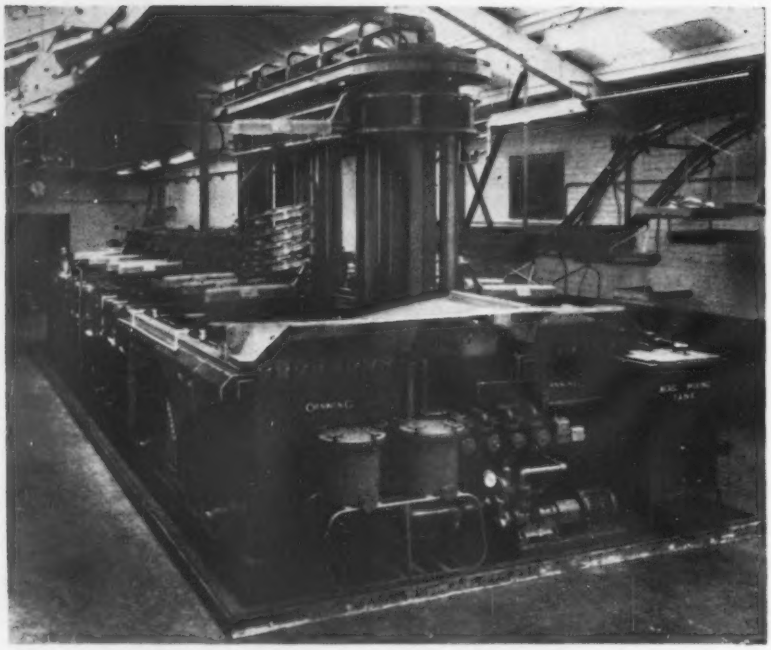
EMPLOYING the multi-cell plating principle, an automatic rim plating plant, the only one of its type in the country, has recently been installed at the Coventry works of Triumph Engineering Limited. It is a special "Trojan" hydraulic return-type unit for the nickel and chromium plating of motor cycle wheel rims; other items such as kick start levers, silencers and brake levers, can also be catered for. Designed and manufactured by W. Canning and Co. Ltd., of Birmingham, this machine, instead of progressing work through the bright nickel tank, sets it down in one of eight different sections or cells, with the rims held horizontally in the jig and surrounding a fixed central core of nickel anodes. Since the work is stationary, it is possible for the anodes to be positioned so that the most efficient current distribution is obtained. The introduction of this new type of automatic has enabled Triumph to increase considerably their output of plated motor cycle rims and, at the same time ensure a high and uniform standard of finish. On a production of 40,000 rims, the reject figure has been less than 0·1 per cent.

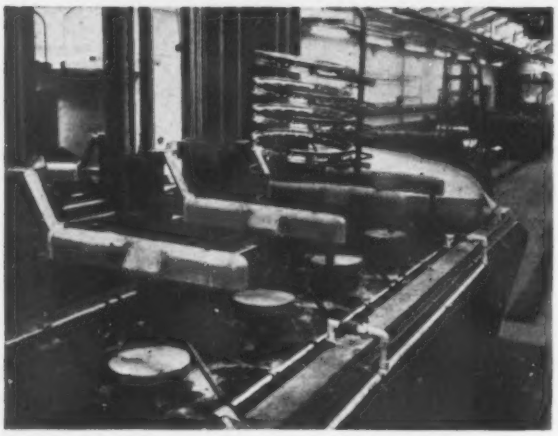
Although it employs the most up-to-date mechanical techniques, the plant is basically an automated version of a Canning rim plating plant introduced over 50 years ago. In this plant, the rims were plated horizontally with a centre anode, the arrangement ensuring that an adequate deposit of nickel was applied to the inside of the rim. While this method has continued in use, it was not applicable to the conventional methods of automatic plating.

The "Trojan" plant supersedes manually operated equipment and is

Loading a jig of rims at the cleaning end of the plant. On the right, jigs of chromium plated rims can be seen passing through the final rinsing stage







Jig of rims being transferred from one of the bright nickel plating cells to the rinse tank and travelling over the stationary jigs in the nickel plating cells. In the foreground is a "Sentinel" filter unit and also the plating-out unit for the bright nickel plating tank

Four jigs of rims in the nickel plating cells, each with a central core of anodes. Passing above is a jig of plated rims from the nickel plating cells on the opposite side of the plant

housed in a new two-storey building. Rectifiers, pumps and ancillary plant are on the ground floor, whilst the actual plating plant is on the floor above. The plating shop has acid-proof tiled floors and a modern exhaust system extracts fumes from the plating shop and dust from the polishing shop.

The overall dimensions of the plating plant are: length 47 ft., width 13 ft., height 12 ft.

It is basically in two sections: the first section, comprising the cleaning and chrome plating tanks and swills, is of standard "Trojan" design, whilst the other section is made up of the specially designed nickel plating tanks. The work arm is transferred between the two sections by means of a solenoid-operated pick-up pawl and carried to a vacant nickel station by a pusher fitted to an overhead transfer chain. An indexing switch determines the loading sequence of the nickel stations, energizing a solenoid-operated lifting and lowering pawl at the empty position.

The "Trojan" plant has an output of 48 rims/hr., the process sequences being given in Table I.

Loading and unloading of the plating jigs are accomplished by one operator. The work arms are provided with additional hooks so that standard type plating jigs may also be used.

During the acid etch process the work is immersed for 2½ min. but, by means of a timing device, the rectifier is only switched on for the final 45 sec. By this means, an evenly etched surface, without any pickling effect, is achieved before the voltage is applied. A system of counterflow rinses is employed after most processes and is a distinct advantage both in saving water and producing a much cleaner final rinse.

Appreciable economies in nickel consumption have resulted from the new method of plating. Using the old method, the rims had to be "over-plated" by as much as four times the calculated processing time to ensure that the spoke band—usually attracting least nickel—received a sufficient thickness. The rim beads attracted four times as much as the spoke bead. This ratio has now been substantially reduced and ductility and adhesion of deposit have also been improved.

Automatic plant employing the cell plating principle can be usefully applied to the plating of many components which are either of complex shape or which need special anode configurations and for which manual processing has, in the past, been necessary if undue variations in thickness of deposit were to be avoided.

TABLE I—PLATING SEQUENCE

Process Tank	Immersion Time (min.)
Load jigs	
Hot soak cleaner	2½
Cold swill	2½
Hot electrolytic cleaner	2½
Cold swill	2½
Cold swill	2½
Acid etch	2½
Cold swill	2½
Cold swill	½
Bright nickel plate	46
Cold swill	½
Cold swill	2½
Chrome plate	5½
Drag out	2½
Neutralizer	2½
Cold swill	2½
Cold swill	2½
Hot swill	2½
Unload jigs	

Ingot Manufacturers Dinner Dance

The illustrations on the opposite page show some of those present at the recent dinner dance of the British Bronze and Brass Ingot Manufacturers Association.

1—Mr. and Mrs. J. H. Barwell, Mr. and Mrs. W. R. Buxton.

2—Mr. and Mrs. W. T. Hobkirk, Mr. and Mrs. Mantell, Mr. and Mrs. Sanderson, Mr. Price, Mr. and Mrs. J. E. Tear, Mr. McNair.

3—Mr. and Mrs. K. Fabian, Mr. and Mrs. J. E. P. Doll, Mr. and Mrs. Bushell, Mr. and Mrs. E. Josephs, Mr. and Mrs. I. Ralphs, Mr. A. Straughan, Mr. Cammerman, Mr. and Mrs. Partridge.

4—Mr. H. Brien, Mr. and Mrs. P. W. Collins, Mr. R. G. Wood, Mr. and Mrs. G. H. Charsley, Mr. and Mrs. V. Evans, Mr. and Mrs. F. Sparkes, Mr. and Mrs. V. Child, Mr. R. R. H. Yates.

5—Mr. and Mrs. E. W. Snowdon, Mr. and Mrs. L. E. Wiltshire, Mr. and Mrs. R. Dowdy, Mr. and Mrs. R. R. H. Yates, Mr. and Mrs. V. Child.

6—Mr. and Mrs. R. Anderson, Mr. and Mrs. D. Austin, Mr. and Mrs. M. Drinkwater, Mr. and Mrs. Harvey, Mr. G. MacDonald.

7—Group including Mr. and Mrs. Stevenson, Mr. and Mrs. Jardine, Mr. and Mrs. McLean, Mr. and Miss Beresford.

8—Mr. and Mrs. G. B. Garnham, Mr. and Mrs. E. Cashmore, Mr. and Mrs. M. Elton, Mr. and Mrs. A. H. Pagan, Mr. and Mrs. N. Tilly, Mr. and Mrs. G. Harvey, Mr. V. Berry.

9—Mr. and Mrs. R. Blandy, Mr. and Mrs. W. J. Pym, Mr. and Mrs. F. Farenden.



Ingot Manufacturers Dinner-Dance

















OUT OF THE MELTING POT

By Reaction

SINTERING in hydrogen provides benefits due to reaction of the hydrogen with the surface oxide and the active metal formed as the result of this reaction. A more purposeful practice is the so-called activated sintering in a reactive atmosphere usually containing a small concentration of a suitable halogen or halogen compound. So far as reactions between the constituents of the powder are concerned, extreme cases are the various metallo-thermic types of reaction, many of which proceed with the evolution of considerable amounts of heat. Most of these, although theoretically promising and practically interesting from the point of view of the combinations of the reaction products that can be obtained, appear, as yet, to be beyond adequate control. It may be that such control could be achieved by arranging for the reaction to progress gradually through the material, while remaining within a relatively restricted region, where it could be kept under control, instead of being allowed to spread to, and encompass, the whole bulk of the material concerned. A much less violent type of reaction is envisaged in a process for making aluminium-lead bearing compositions, in which aluminium or aluminium alloy powder (325 mesh) is mixed with a lead halide (e.g. lead chloride) and the mixture is compacted and sintered. At the temperature used for the sintering (300°-640°C.), the aluminium reacts with the lead chloride, reducing it to metallic lead and forming aluminium chloride. Depending on the density to which the mixture has been compacted, and on the temperature, sintering is continued for a sufficiently long time to ensure the practically complete removal of the aluminium chloride by volatilization. The starting mixture can have a composition within a very wide range, and halides of indium, cadmium, thallium, copper, silver and tin can be used instead of lead chloride, either singly or in combination.

Self Examination

IN spite of occasional suggestions, the idea of doing research on research has, for some reason or other, failed to catch on. There have, of course, been investigations into various aspects, mostly statistical, of research. Much has also been said and written on the administration, the personnel and even the personal aspects of research. All this, however, can hardly qualify as research on research. The latter would be expected to concern itself with the various fundamental aspects of research. One such aspect comprises the factors governing the choice of research subjects. To what extent is such choice influenced by expectations of success and/or profitability, by research already in progress elsewhere, by personal interests and inclinations, and by fashions? There seems to be a good deal of evidence that many of these factors are of a kind that bring about a high degree of conformity to a pattern in the choice of research subjects. This conformity may or may not be an inherent scientific characteristic of research. On the other hand, research may show that it is neither inherent nor scientific, but merely one of those human factors which elsewhere are being eliminated by mechanization, automation, standardization, and similar measures. Having decided the matter, fundamental research on research could go on to see to what extent this human factor could be eliminated. If, as would appear to be probable, it cannot be eliminated altogether, should it, on the contrary, perhaps be stimulated and increased. There would then also be a case for examining why it should be operating almost exclusively in one direction, and whether a measure of nonconformity could not be stimulated to some advantage. All this presupposes that research on research is possible, whereas the reason why such research has not, so far, been started may be that it is impossible in principle—like pulling oneself up by one's shoelaces.

Modern Type

HAZEL twigs may have been an excellent means for detecting the presence of water, metals and other materials by those skilled in the art of dowsing. A new appliance for this purpose comprises an L-shaped chromium plated rod, $\frac{1}{8}$ in. in diameter. This rod is arranged so that the upright portion of the "L", which is 2 ft. long, is horizontal, while the horizontal portion of the "L" points vertically downwards. The latter portion extends into an inner sleeve, $\frac{5}{16}$ in. in diameter, arranged axially in a cylindrical copper tube $\frac{3}{4}$ in. in diameter and 9 in. long. The lower end of this tube is closed by means of a brass cap. The upper end is also closed by a cap which is bored to take the inner sleeve into which the vertical portion of the L-shaped rod extends. The interior of the tube is divided into a number of compartments by floating copper discs which fit loosely on the sleeve and just clear the inner surface of the copper tube. The spaces or compartments between these copper discs contain, respectively and in order, brass or copper powder, a set of copper needles each of which has a point at each end, the points seating in dimples in the surface of the discs arranged so that the needles are held spaced in a circle around the axis of the copper tube, and a light gauge coil spring which is mounted on the sleeve and acts upon two adjoining copper discs to keep them apart and, through them, to exert pressure on the adjoining compartments which contain the copper powder and the compartments in which the copper needles are held. Two such appliances have to be used. The prospector holds them—one in each hand—by the horizontal portions of the L-shaped rods, these portions being held about 10 in. apart and pointing forwards. As the prospector moves over metal, water or other material or objects to be detected, the rods converge.

Skimmer

Electric Heating for Non-Ferrous Metals

By J. T. Sharples, B.Sc. Tech., A.M.I.E.E.

(*Continued from* METAL INDUSTRY, 27 *October* 1961)

ALTHOUGH, historically, vacuum melting goes back 50 years or so, the extensive developments taking place now had their real beginning with the demands from the atomic and aircraft engineering industries and the advent of the large vapour-type pumps which have made very high vacua possible.

These developments have made available a whole series of new alloys and alloy improvements for critical applications. It is logical to assume that the ever-widening demand for improved high - temperature performance, for more power and speed in everything from lawn-mowers to missiles, will call for still more developments of vacuum processes for melting and heating. No doubt, equipment and process improvements will develop a trend towards lower costs and this, in turn, will tend to increase the applications in the commercial field. Hence, the metals industry may well enter a new phase.

Except for some pit and bell type furnaces used for bright annealing under vacuum, vacuum furnaces for heating and melting generate heat within the evacuated chamber, avoiding the potential troubles associated with creep and distortion of a hot-walled vessel, and hence electric heating is invariably essential. Resistance, induction and arc heating are all employed in vacuum furnaces, while a newcomer in the form of electron beam bombardment has now emerged from the laboratory. It seems appropriate to discuss vacuum furnaces in terms of the heating method used and to give some indications of the applications appropriate to each.

Resistance Vacuum Furnaces — A recent development in the vacuum heating field, forming the exception to the general use of the "cold retort" type, is the bright annealing of copper wires in bell furnaces. Although such furnaces are similar in design and operation to controlled atmosphere furnaces, it is claimed that installation and running costs are much more favourable. The wire is fully annealed in a clean and bright condition with complete freedom from sticking between turns.

The first British installation is claimed by Efco Ltd. at the works of F. D. Sims Ltd., near Manchester, for annealing copper wire in coils or wound on reels. One furnace bell rated at 85 kW and operating up to 550°C. serves six bases supporting the vacuum-tight containers capable of a charge weight up to 3,500 lb. The heating period is normally of 4 hr. and cooling within the containers from 12 to 20 hr. Designed output is 34 tons of wire per working week of 120 hr. The furnace bell is heated by circumferential coils divided into three separately controlled zones, the electrical connection to each base being made automatically, and the consequent uniformity of heating greatly assists the reliability of the equipment and the avoidance of container troubles.

The operating vacua are obtained by "Speedivac" pumping gear supplied by Edwards High Vacuum Ltd., and either roughing pumps or process pumps can be connected at will to any base, the whole furnace installation being easily managed by a single operator (Fig. 13).

Similar equipment has also been commissioned by G.E.C. Ltd., and a particularly interesting G.E.C. installation of this kind is due to be commissioned for Pirelli-General Ltd. for bright annealing copper wire or strip coils or wire on spools to a rated output of 250 tons/week. In this, and contrary to normal practice, each of four identical furnaces, about 7 ft. dia. by 8 ft. high and rated at 114 kW, will be fixed in an elevated position, and a base carrying its vacuum chamber and included charge will be lifted into the furnace by hydraulic ram. A system of rails enables trolleys to carry the bases from loading point to the vacuum roughing station and thence to one of the furnaces, where the high vacuum pumping connection is made. Each base will carry 2½ tons on three shelves supported one above the other. A full complement of bases and hoods is provided to allow a continuous but flexible annealing programme to be followed, the operator being required only to load and unload the bases, hydraulically assisted, and to move single bases on the rail system. Cooling can be accelerated, when required, by flooding the containers with a gas.

The cold retort type of resistance heated vacuum furnace is being used for annealing, degassing, high temperature brazing and sintering, particularly of the more reactive metals, but is not greatly used on a production scale for

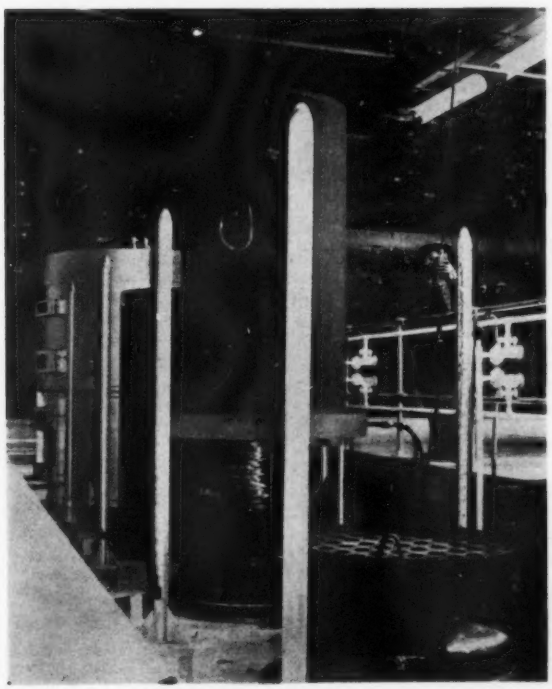


Fig. 13—Bell type vacuum annealing furnaces by Efco Furnaces Ltd.

melting. The vacuum chamber, normally cylindrical, contains means for supporting the charge centrally, the resistance heating elements surrounding the charge and being, in turn, surrounded by a system of radiation shields designed to assist an external water cooling system to keep the chamber walls cool. Although at first glance the absence of oxidation at high temperatures should allow a wide choice of resistor materials, considerations of vapour pressure and reaction to the gases ejected from the charge narrow the range, and molybdenum, tungsten, tantalum and graphite are usually used. Vacua range down to 10^{-5} mm. Hg or better, and temperatures up to 2,000°C. or higher.

As already mentioned, one of the applications of this type of furnace is vacuum brazing, and G.E.C. Ltd. have recently commissioned a 150 kW furnace for brazing Nimonic 75 components as well as for heat-treatment. This equipment has a charge space of 24 in. dia. by 36 in. high and operates up to 1,300°C. at pressures down to 10^{-4} mm. Hg. A novel feature is that the charge may be quenched in water directly from the heating chamber. Fig. 14 shows a furnace of this type, although without the quench tank fitted, as installed by G.E.C. for Nimonic brazing at their own Witton works. A larger, 300 kW furnace for a similar purpose has been produced for export by the same firm.

The thermal mass of the resistors and the radiation shields may delay the cooling of a resistance furnace after heating has ended and to combat this arrangements can be made for introducing an inert gas. An extension of this arrangement provides that a trap between the chamber and a sealed hood below it is opened when the pressures in the two spaces are equal, the charge then being lowered into a quench tank. Furnaces can be obtained for vacuum purging followed by controlled atmosphere filling and including means for giving forced convection heating or cooling.

Induction Vacuum Furnaces—Induction vacuum furnaces, as typified by Fig. 15, are widely used for melting, refining and alloying processes because heating is quick but accurately controllable, the induced stirring effect is useful, particularly in alloying, and not least because the melting crucible can be formed *in situ*. Moreover, when, as is usually desirable, casting as well as melting is carried out under vacuum it is easier to arrange for pouring from the crucible in an induction furnace, which has no radiation shields. In most cases there is no difficulty in generating heat directly in the metal charge but in a few cases, as for example a finely divided material such as beryllium flake, it may be necessary to use a susceptor for the heat generation.

Furnaces for melting and casting on a production scale are usually of the semi-continuous type and enable several castings to be made with one evacuation of the furnace. The moulds are carried on a turntable in the bottom of the furnace and can be brought in turn beneath the melting crucible, from which the metal is poured either by tilting the crucible or by removal of a solid plug in the crucible base. Topping up of the crucible is effected from a bulk charge loader towards the top of the chamber and from one or more smaller holders containing any alloying constituents required. Metal temperature can be checked by optical pyrometer through a sight hole and can also be measured by a dip type thermocouple, particularly useful in the final stage. All these components, which are arranged to move within the furnace are operated externally, mechanically or electrically, without breaking the vacuum. Semi-continuous furnaces not only give higher production rates by eliminating the cooling and re-evacuation periods necessary in batch furnaces but also lead to further economy by charging the metal into a hot crucible, utilizing heat otherwise wasted and also prolonging crucible life by reducing temperature changes. These economies can justify in many cases the increase in initial costs occasioned by the vacuum locks and operating mechanisms.

A development of the above arrangement, which brings the furnace closer to continuous operation, is the provision of a mould lock connected with the main chamber through a sliding door. A mould can be moved into the mould lock on a trolley, the lock evacuated and the sliding door then opened to allow the mould to be brought beneath the crucible for casting. The trolley is then moved back into the mould lock and the sliding door closed, after which the mould can be removed from the lock and replaced by a fresh one without affecting the main chamber. The period of continuous operation is thus only limited by any need arising for patching or relining the crucible assembly. Fig. 16 shows a 1 ton furnace of this type, and Fig. 17 a smaller, 50 lb. furnace supplied by Wild-Barfield to Bristol Siddeley Engines Ltd. for investment casting. This clearly shows a mould lock with a mould in position on the table. It is interesting to note that nickel chromium alloys cast in this furnace have already been vacuum melted by Jessop-Saville Ltd. in two 600 lb. vacuum induction furnaces. These

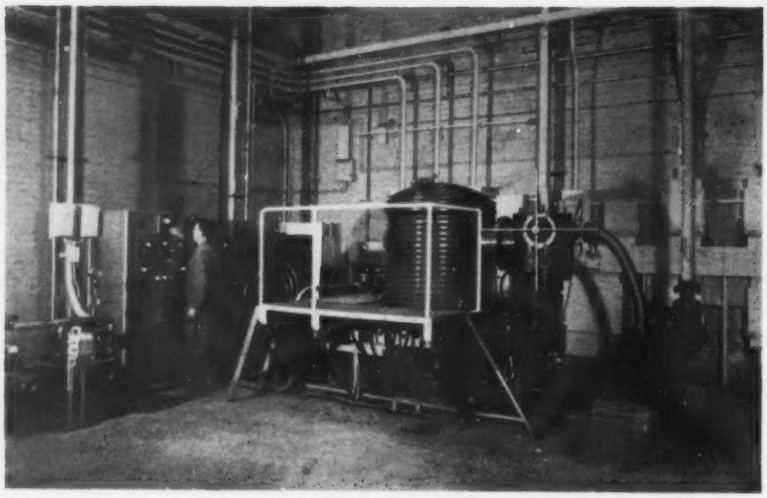


Fig. 14—G.E.C. 120 kV vacuum furnace for brazing Nimonic alloys

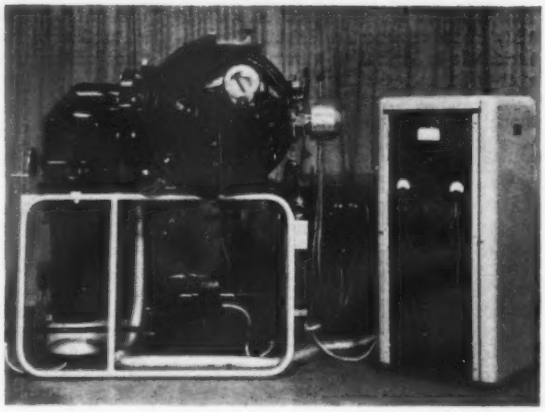


Fig. 15—A G.E.C. standard type vacuum induction furnace as produced in collaboration with V.I.A. and GECO

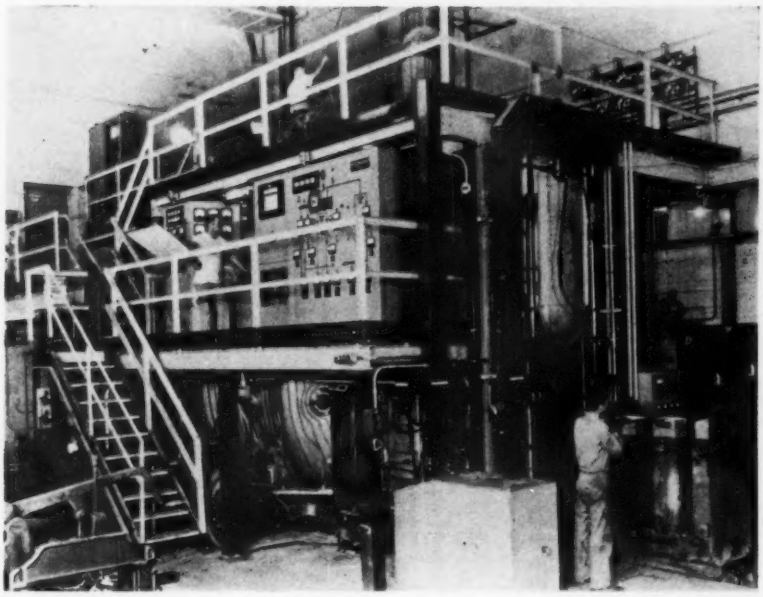


Fig. 16—Wild-Barfield 1 ton vacuum induction melting and casting furnace with trolley loaded vacuum lock

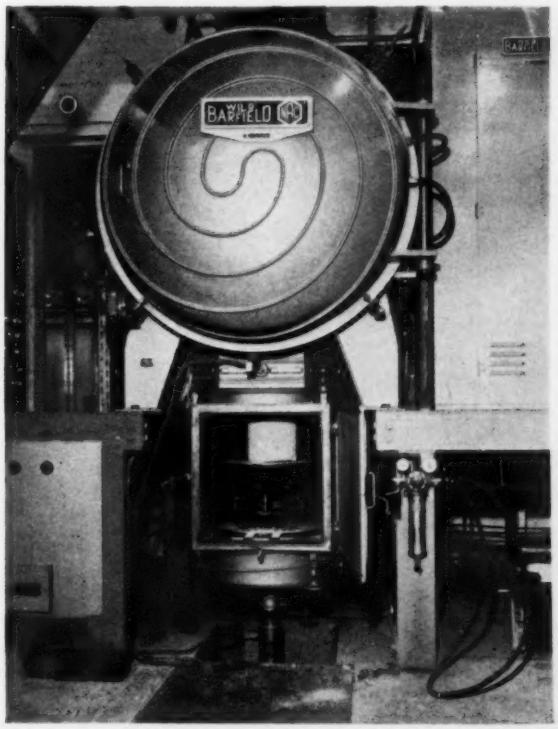
were also installed by Wild-Barfield.

Another design variation, as used, for example, in the vacuum casting of uranium billets, has the induction coil on the outside of the evacuated melting chamber. One such plant, as developed on a pilot scale by the U.K.A.E.A., has recently been described in which the coil is external to a silicon brick-lined tube housing a graphite melting crucible and sitting on top of a water-cooled steel mould chamber, also evacuated. Pouring is effected by lifting a graphite bung in the crucible, the metal flowing into a tundish which directs it on to graphite separating discs which, in turn, direct the metal into the billet moulds.

An example of the use of mains-frequency induction in the vacuum field is given by the equipment supplied by Birlec-Efco Ltd. for the vacuum refining of nickel-base alloys (Fig. 18). This comprises, basically, a standard 15 cwt. mains-frequency coreless induction unit housed in a vacuum tank mounted on trunnions so that the whole assembly can be tilted. The vacuum pumping lines are connected to the tank concentrically with the tilting trunnions to avoid disconnection when tilting, and the lid of the vacuum tank is hydraulically operated but pneumatically held. The crucible is charged with metal melted elsewhere and at the end of the refining and degassing period, about an hour, vacuum is reduced, the lid opened and the metal directed into a ladle through a retractable spout. This type of equipment avoids the cost of a frequency generator, has a rather higher overall efficiency than the H.F. type, and is probably suitable for quite a wide range of metals, although not for such as titanium. The vigorous stirring action aids both alloying and degassing, and the equipment provides an attractive new tool for the melting shop wishing to take advantage of the benefits of vacuum melting and refining.

Vacuum Arc Furnaces—Production scale vacuum arc furnaces were primarily developed for melting titanium and are in extensive use for this and other metals such as zirconium, molybdenum, tungsten, etc., which by reason of their reactive behaviour or high melting point cannot be satisfactorily melted in a refractory crucible. They are divided into two categories, using respectively consumable and non-consumable electrodes, and into the cold mould and skull types.

The consumable electrode furnace is essentially a remelting furnace since the electrode is formed of the metal required as the final product, usually as a casting from a conventional melting method or as a sintered product, and is best suited to production of ingots of fairly large cross section. In the cold mould type, the electrode is held vertically above a water-cooled copper ingot mould and is melted by a high current low-voltage arc initially struck between the electrode and scrap in the bottom of the mould, and subsequently maintained during melting between the electrode tip and the molten top surface of the ingot being formed. This process takes place in an evacuated chamber, usually at pressures between 0·1 and 1·0 mm. Hg but depending upon the lowest vapour pressure of the constituents present. In some cases, the evacuated chamber is flooded before melting with an inert gas, normally argon, where one or more of the constituents vaporize at pressures above the levels normally used for vacuum melting. In the modern plants high and creep speed control of the electrode movement, with accurate control of arc current, rapid making



[Courtesy Bristol Siddeley Engines Ltd

Fig. 17—Wild-Barfield 50 lb. vacuum induction melting and casting furnace showing vacuum lock

and breaking of the vacuum pumping circuit, and other improvements on the original designs have made upkeep and operating procedure much simpler. Attention to mould design and precise positioning of the electrode to discourage arc wandering have practically eliminated the early trouble of water escape. In addition, there are developments in the way of using "dry" moulds having sufficient copper mass to act as a heat sink during melting, and the use of a liquid metal coolant, such as sodium-potassium, which does not react with any of the known "reactive" metals. The cold mould furnace can be operated with a non-consumable electrode, such as a tungsten or tungsten-tipped electrode, when the charge cannot conveniently be formed into an electrode shape and is fed instead into the mould by vibrating feeder or endless belt.

The non-consumable electrode is more often associated with the skull type furnace, which is not confined to ingot production and may be used for pouring castings and also for melting scrap and large pieces. The charge is contained in a water-cooled bowl-shaped crucible and as melting proceeds the layer against the internal wall freezes and forms the skull. The crucible can be externally operated to pour into a shaped or ingot mould. This type of furnace can be operated solely with non-consumable electrodes or a combination of consumable and non-consumable electrodes.

A Wild-Barfield vacuum arc furnace for use with consumable or non-consumable electrodes is shown in Fig. 19 in course of erection. Vacuum arc furnaces capable of producing 50 in. and 60 in. ingots are in service in America; work is proceeding towards one capable of 100 in. ingots, and development work is being expanded to determine the best method of approach to future very large furnaces.

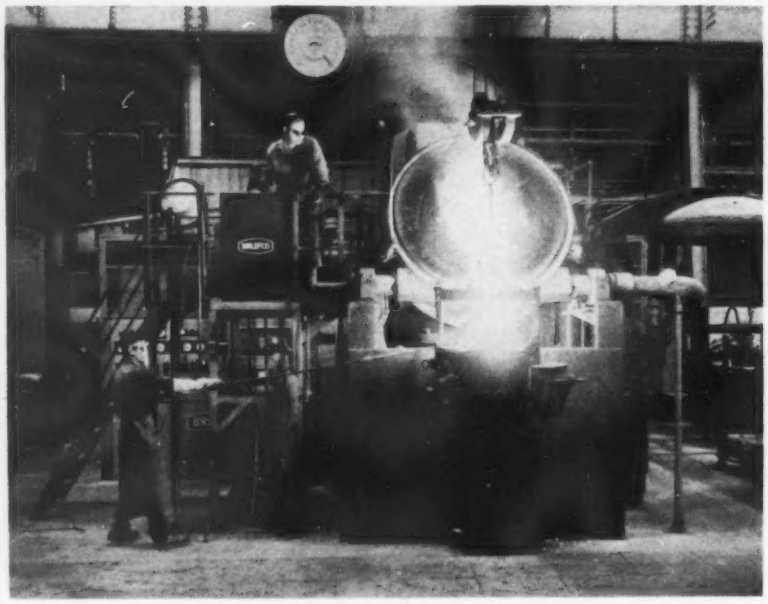


Fig. 18—Pouring from a Birlec-Efco 15 cwt. mains frequency coreless induction vacuum furnace used for vacuum refining of special nickel-base alloys at Henry Wiggin & Co. Ltd.

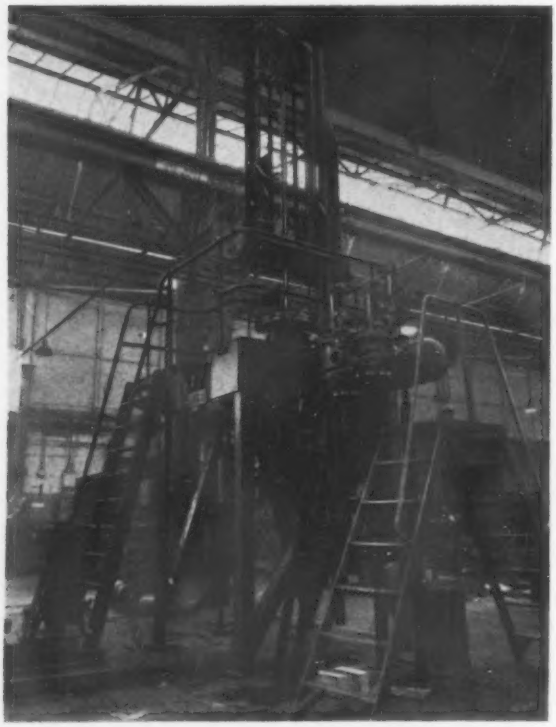


Fig. 19—Wild-Barfield vacuum arc furnace in course of erection

Although initially developed for titanium and similar metals, changes in defence programmes, etc., shifted the demand, and vacuum arc melting was tried with success for meeting rigid specifications of other metals; for example, in the melting of nickel-base superalloys. Quality improvement brought about by consumable electrode ingot melting includes substantial reduction or elimination of non-metallic inclusions, virtual elimination of segregation of alloying elements and axial discontinuities in the ingot and attendant gains in physical properties. It is difficult to make comparisons of the arc and induction vacuum processes, as although there is an overlapping area they serve generally different needs and there is a place for each. In some cases, it may be desirable to use the product of the vacuum induction furnace as the electrode of the vacuum arc furnace to achieve maximum quality in large section ingots.

The Battelle Memorial Institute has been experimenting with water-cooled copper crucibles for vacuum induction melting of reactive metals such as titanium, and has come to the conclusion that this is a technically feasible process. Only sm ll charges of titanium have been melted in a specially segmented copper crucible, with no indication of contamination. If brought to commercial development, vacuum induction melting of this kind could have considerable advantages, since it does not involve electrode forming, the stirring action aids homogeneity, the cold crucible will accept scrap and other forms of raw material and there is higher production flexibility.

(To be concluded)

Industrial News *Home and Overseas*

Wire Feed Speed Monitor

The need to measure accurately the rate at which wire is being fed to a given point exists in a number of industrial processes. **The British Welding Research Association** has developed and constructed a monitoring instrument which is independent of the feed rolls and which produces a signal capable of reproduction either on an oscilloscope or as a direct "inches per minute" meter reading.

In the new instrument the wire itself is made to drive a milled spindle to the end of which is attached a disc having regularly spaced slots around its periphery. The disc, in turn, is positioned between a small lamp and a photoelectric cell. As the disc rotates, the light beam is interrupted and the electrical resistance of the cell alternates accordingly, the cycles taking place 72 times with each revolution of the driving spindle.

The change in electrical resistance, applied to a transistorized amplifying circuit, produces a square wave output signal which is fed into an electronic frequency meter coupled to a direct reading "inches per minute" scale. For maximum accuracy the instrument is calibrated for 0-30, 0-300, and 0-600 in/min., the entire scale being used in each range, which is selected by means of a switch.

Since the value of the light energizing the photo cell must remain constant a position is provided on the selection switch for measuring the output of the 6 volt battery supplying the lamp. A minimum value is indicated on the meter scale below which the accuracy of the instrument falls off, and this serves as a warning that the batteries should be replaced.

The monitoring head itself measures 3 in. in diameter by 1 in. deep and is small enough to be incorporated into the drive roll housing of many commercially available wire feed units. It will handle wire up to $\frac{1}{8}$ in. diameter. An additional use for the monitoring instrument is in measuring traversing or rotating table speeds in mechanized welding operations.

Zinc and Lead Exhibits

This year the **Zinc Development Association** has arranged with the **Lead Development Association** to participate on adjoining stands at the Building Exhibition to be held at Olympia this month, and an impressive two-tier exhibit has been designed for both Associations.

The Z.D.A. stand has been designed to demonstrate some of the uses of galvanized structural steelwork and sheet zinc, now being employed on an ever-increasing scale in modern building construction. The prefabricated lightweight beams and supporting columns, all made of galvanized steel, are typical of those currently used in modern schools and factories. Galvanized scaffold poles with sherardized fittings, widely accepted by the building industry, feature on the stand, and decorative applications for galvanized steel are illustrated in the expanded metal panels forming the balustrading of the balcony. Architects, builders and designers will be particularly interested in these examples of the outstanding merits of hot galvanizing as an effective and cheap method of protecting steel from rust.

Full size sections of zinc roofing, flashings and weatherings show the practical application of sheet zinc in building, and visitors are invited to examine the exhibits and detail from the balcony on the upper floor of the stand. Photographs and colour transparencies on display also illustrate some of the current examples of zinc applications in many modern building projects in the U.K. A full range of technical publications on all uses of zinc will be available, and technical experts will be present to advise on design and practical problems.

Aluminium-Clad Chimney

A recent example of the application of the technique of cladding steel chimney stacks with aluminium is to be seen at the Southampton works of the Southern Gas Board. Here, a steel stack 150 ft. high, designed, manufactured and erected by F. E. Beaumont Ltd., can claim the distinction of being the tallest aluminium-clad chimney in the world.

For the cladding, the constructors used, in accordance with their general practice, 16 gauge sheet in BA.60 alloy, with flange covers in roll-formed super purity aluminium. All aluminium was supplied by **The British Aluminium Company Ltd.**

From the aesthetic standpoint, the aluminium cladding effects quite definite improvements and, indeed, it may be claimed to give the stack the value of an architectural feature.

A Film Display

At a press preview held at the Strand Palace Hotel in London on Tuesday of last week, the **Carborundum Company Limited** presented to a large gathering their films—"The Winning Tip", "Heat in Harness", and "To be Precise". The first of these films deals with the use of ceramic-tipped cutting tools and shows how this method produces astonishing results.

The second film—"Heat in Harness"—designed to show the benefits of super-refractories by Carborundum, was accompanied by a booklet, which contains many details relating to the various advantages accruing from the use of the company's refractories.

U.S. Loan to India

According to news from New Delhi, the United States will lend India $20,000,000 for the purchase of non-ferrous metals under the terms of an agreement signed last week. The loan, to be channelled through the U.S. Development Loan Fund, will be repayable in Indian currency. The money will be used to buy from the U.S. aluminium, copper and zinc to meet the demands of the expanding Indian industry.

New Wing Opened

On Monday of last week, the new instrument assembly wing of the **Cambridge Instrument Company Limited** was officially opened by Sir Keith Joseph, Bt., M.P., Minister of State, Board of Trade, at Cambridge.

The outstanding features of this new wing are the clean functional sweep of its two raised storeys, the ground-level car park beneath, and the harmonious way it blends with the research laboratory building — opened two years ago — to which it has been planned as a logical architectural extension. The two raised storeys provide a working area of approximately 15,000 ft^2 and are joined at one end to the research laboratories and at the other, by means of a two-storey link block, to existing works buildings.

Two-thirds of the first floor area is occupied by offices, the other third being taken up by the microanalyser production department. The whole of the second floor area is used as a workshop for instrument assembly and testing, both production departments being connected by air-locks to a link block containing stairs and a lift.

Packaged Air Conditioners

Visitors to the International Factory Equipment Exhibition, which is being held this month from November 13 to 18, are invited to visit Stand No. B.28, where the **Fuel Efficiency Company Ltd.** will be showing a number of packaged air conditioners manufactured under American licence, the units being available in packages ranging from 1-100 tons.

The range includes wall, window, floor, ceiling and duct mounting models. The packages are suitable for cooling a single office or a complete building and there is provision for various forms of heating. On display also will be a range of Swiss manufactured packaged humidifiers (Aerosol Atomizers) which provide an efficient low cost solution for correct environment and process humidity levels. Exhibited also will be a control panel for a completely automatic boiler plant.

Novel Aluminium Construction

Built on the new lift slab principle, the Austin multi-storey car park at Longbridge, Birmingham, is stated to be the largest of its type in the world. It has been designed for storing production cars awaiting delivery to the docks or to dealers. The capacity is 3,300 vehicles.

A most striking feature of the building is the cadet-grey enamelled aluminium balustrade which surrounds each floor to a depth of 4 ft. This is constructed in **British Aluminium Company's** Rigidal LT.7 and is fixed to a steel balustrade structure.

In all, some 45,000 ft^2 of aluminium sheet were used for this purpose, amounting to about 17 tons in weight. In addition, some 10,000 ft. of matching aluminium balustrade capping has also been used.

Gauge and Tool Makers

Advance notice is given by the **Gauge and Tool Makers' Association** of the annual general meeting, which is to be held this year at 12 noon on Tuesday, December 12, at the Connaught Rooms, London, W.C.2.

This meeting will be followed by a members' luncheon at the Connaught Rooms, at which the Association's Certificate of Craftsmanship and Certificate of Gauge and Tool Design and Draughtsmanship will be presented to successful applicants during the past twelve months.

Also to be presented at the luncheon

will be the prizes and certificates in the Association's ninth competition in Craftsmanship and Draughtsmanship for apprentices and learners employed with member-companies.

Spanish Lead and Zinc

Spanish production of lead in September totalled 6,130 tons, compared with 5,732 tons in August and 2,587 tons in September last year, according to statistics issued by the Metal Syndicate. This brought total production during the first nine months of this year to 46,741.

Production of zinc in September was 3,306 tons, compared with 2,723 tons in August and 3,136 tons in September last year. Total output in the first nine months of this year amounted to 26,395 tons.

Belgian Firm Acquired

It has been announced by **Johnson, Matthey and Co. Limited** that they have acquired the majority of the shares of the Belgian precious metal company, Pauwels Frères S.A. This Belgian company, established in 1864, has a long history of friendly relationships with Johnson Matthey and for over 30 years has acted as their principal agency in Belgium. The company has offices and works situated on one of the main boulevards of Brussels.

The future name of the Belgian company will be Johnson Matthey & Pauwels S.A. Mr. H. Limbourg, hitherto general manager, becomes managing director, and Mr. L. Mendel the general manager, while Mr. R. Turner and Mr. P. G. Smyrk (directors of Johnson Matthey) join the board of the Belgian company.

Since 1956, Johnson Matthey have acquired manufacturing and trading interests also in France, Holland, Italy and Sweden.

Friction Materials on Show

"Sinter-Don" sintered metal friction materials for a wide range of wet/dry industrial applications will be a central feature of attraction on the stand (No. D.14) of **Small and Parkes Limited** at the Engineering Materials and Design Exhibition which opens at Earls Court on November 13. "Don" industrial brake linings and clutch facings, both woven and moulded, and "Donflex" industrial clutch discs will also be shown.

Visitors will also be able to see a selection of "Karmal" engine packings, "Fepco" jointings, "Grooved Roko" and "Roko Nylon" transmission beltings.

Powder Metallurgy Techniques

One of the new specialized processes now widely adopted by industry is the use of self-lubricating bearings, filter elements and structural parts manufactured by powder metallurgy techniques. In this field, one of the acknowledged exponents is **Bound Brook Bearings Ltd.**, one of the Birfield group of companies.

At the forthcoming Engineering Materials and Design Exhibition, to be held at Earls Court this month, Bound Brook exhibits will help to explain the growing tendency to make more use of parts produced by these techniques. In general, the company's sintered parts are supplied in brass, bronze, iron, iron alloy and various special purpose alloys. When used as bearings they are impregnated with oil or P.T.F.E.—dependent upon the application for which they are designed. In all cases, however, an important advantage in the use of sintered parts lies in the complex shapes which can be produced to close limits of accuracy without subsequent machining.

Trade names for Bound Brook parts produced by powder metallurgy methods are "Lubrook" for all bronze bearings and parts; "Ferrocite" for iron-based bearings and parts; and "Polyslip" for dry bearings in which the bronze matrix is treated with P.T.F.E.

Corrugated Aluminium Sheathed Cables

An interesting order has been received by the **British Insulated Callender's Cables** group of companies from the Electricity Trust of South Australia for the supply and installation of some 4,625 yd. of 66 kV corrugated seamless aluminium sheathed cables in the Adelaide area. It may be recalled that the group also received, earlier this year, a contract from the Southern Electricity Authority of Queensland for the supply of single- and three-core 33 kV C.S.A. sheathed cables and accessories for installation at Bulimba, near Brisbane.

The cables under the present contract are 0·75 in^2 single-core oil-filled, with corrugated seamless aluminium sheaths protected overall with an extruded P.V.C. oversheath which enables routine voltage tests to be applied to the sheaths to prove the integrity of the serving. The cables will be buried direct in the ground. The contract also calls for the requisite sealing ends and auxiliary equipment.

New Research Centre

Built and equipped in three years at a cost of nearly £200,000, the Central Research Department of **British Ropes Limited,** was opened on Friday of last week by Mr. Niall Macpherson, M.P., Parliamentary Secretary to the Board of Trade.

This research unit comprises wire and rope research departments and a marine testing station off the Norfolk coast. In the wire department, investigations range from raw material through heat-treatment and wire-drawing to the final product. The quality of hard drawn wire is governed to some extent by the quality of the raw material—wire rods. The department is making an extensive study of the characteristics of the regular supplies of rods, particular attention being devoted to the number and type of surface defects. This is long-term work, but work which, it is hoped, will result in an improvement of raw material quality.

The other half of the central research department (the rope department) is divided into six sections: chemical analysis, metallurgical examinations, physical testing, fibre and synthetics evaluation, photographic documentation, and development.

An Annual Meeting

Held in Brussels recently, the annual meeting of the **Organization of European Aluminium-Smelters** was attended by representatives from the industry in Belgium, Denmark, Germany, France, Great Britain, Italy, The Netherlands, Austria, Switzerland and Spain.

In his speech, the secretary, Dr. Uhlig, dealt in particular with the present situation of the aluminium smelters' industry and outlined its future in comparison with the American aluminium industry. Dr. Uhlig underlined the desire of members to establish in the future as stable a market as possible and a firm price for aluminium secondary material.

In a subsequent speech, Mr. F. Smith, head of the London technical office of the association, reported upon the necessity of technical co-operation of all smelters and, giving examples, called attention to the future tasks and aims of such a co-operation, particularly the standardization of aluminium alloys as well as the exchange of technical experience.

Foundry Trades Exhibition

At the Foundry Trades Technical Societies Exhibition, to be held in Sheffield next week, **F. W. Berk and Company Limited,** and their associates, Berk Exothermics Ltd., will be showing a number of their raw materials for the foundry industry on stand No. 18.

The F. W. Berk section of the display will be concentrated on three products or

Forthcoming Meetings

November 6 — Institute of British Foundrymen. Sheffield and District Branch. Odeon Ballroom, Chesterfield. "Man and His Machines." Sir Ben Lockspeiser. 7 p.m.

November 7—Institute of Metals. Oxford Local Section. Cadena Café, Cornmarket Street, Oxford. "Bearing Materials." P. G. Forrester. 7.15 p.m.

November 7—Institute of Metals. South Wales Local Section. College of Technology, Swansea. "Hot Extrusion of Non-Ferrous Metals." Prof. A. R. E. Singer. 6.30 p.m.

November 7—Institute of Metal Finishing. Midland Branch. James Watt Memorial Institute, Great Charles Street, Birmingham. "Automatic Control of Electroplating Processes, including Analysis of Solutions." G. Mattock. 6.30 p.m.

November 7—Non-Ferrous Club. Ambassador Club, Augustus Road, Edgbaston, Birmingham. Luncheon Meeting. Miss Olga Franklin. 12.30 p.m.

November 8—Institute of Metal Finishing. Organic Finishing Group. Borough Polytechnic, Borough Road, London, S.E.1. "Atmospheric Pollution and Paint." G. L. Holbrow.

November 8 — Institution of Production Engineers. Wolverhampton Branch. Wolverhampton and Staffs. College of Technology, Wolverhampton. "Industrial Research in Britain." P. Spear. 7.15 p.m.

November 9—West Cumberland Metallurgical Society. Primary School, Seascale. "Electron Microscopy." Prof. J. Nutting. 7.30 p.m.

November 9—Institute of Metals. Birmingham Local Section. College of Technology, Gosta Green, Birmingham. "The Welding of Metals." D. R. Thorneycroft. 6.30 p.m.

November 9—East Midlands Metallurgical Society. Derby and District College of Art, Derby. "Electron Beam Welding." M. Harper. 7.30 p.m.

November 9 — Institution of Plant Engineers. North-East Branch. Roadway House, Oxford Street, Newcastle upon Tyne. "Automatic Boiler Control for Medium and Small Size Boilers." 7 p.m.

groups of products: Berkoal, processed peat; Petrobond binder, a specialized bonding medium; and three clay products, Wyoming Bentonite, Berkonite and Berkbond.

Berk Exthermics Ltd. will be showing a number of castings and ingots fed with their materials. The reduction in head column resultant from the use of these products will be demonstrated. Samples of sleeves for foundry use, in various grades of powder dependent upon the type of metal and size of the castings involved, and of a variety of head box units and tiles used in the ingot-making side of the industry will also be on view.

Change of Dates

It has been announced that the President of the **Bureau International de la Récupération** has decided, after having consulted the affiliated associations, to change the dates of the Amsterdam Congress, which will now be held on Thursday and Friday, November 23 and 24, at the Carlton Hotel.

This change of dates has been made at the request of the Non-Ferrous Metal Section, to enable B.I.R. delegates to take part and be informed of the result of the meetings on November 16 and 17 of the O.C.D.E. Non-Ferrous Metal Committee.

A Birmingham Event

On Tuesday next, November 7, at 12.30 p.m. for 1 p.m., the **Non-Ferrous Club** will hold one of its luncheon meetings of the winter session at the Ambassador Club, Augustus Road, Edgbaston, Birmingham. The guest speaker on this occasion will be Miss Olga Franklin, a noted London journalist.

Vacuum Furnaces

Under this heading on page 346 of last week's issue of this journal (October 27), reference was made to the vacuum furnace activities of **Efco Furnaces Limited,** which are to be handled by a new division of the company. The name of the sales manager was wrongly given as W. Huyser. This should have been Mr. W. Kuyser, and we are glad to be able to make this correction.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell by 122 tons to 4,433 tons, comprising London 1,446, Liverpool 1,583 and Hull 1,404.

Copper stocks fell by 590 tons to 15,560 tons, distributed as follows: London 450, Liverpool 13,110, Birmingham 50, Manchester 1,875, Hull 50, and Glasgow 25 tons.

Lead duty-free stocks rose by 575 tons to 7,657 tons, comprising London 7,157, Glasgow 200, Swansea 100, and Manchester 200 tons. In-bond stocks remained at 3,527 tons, all in London.

Zinc duty-free stocks rose by 260 tons to 7,624 tons, comprising London 2,678, Glasgow 66, Hull 425, Manchester 300, Liverpool 55, and Avonmouth 4,100 tons. In-bond stocks fell by 175 tons to 2,863 tons, all in London.

B.M.S. Meeting

Giving his address on Thursday, October 26, as the new President of the **Birmingham Metallurgical Society,** Mr. S. Heslop, F.I.M., A.C.T.(B'ham), took as his theme "Designing for Quality". He dealt in some detail with those aspects of design from the engineering viewpoint in which consultation between metallurgist and designer was beneficial. Early co-operation at the design stage could avoid many problems on the shop floor and in service. Stress raisers could be avoided, materials could be selected suitable for the machining, heat-treatment and ultimate service they would have to encounter. Material properties could be more specifically stated, as, for instance, direction of flow in forged components, grain size and surface finish. He emphasized that all too often these points, which were, in fact, concerned with metallurgy at the design stage, were overlooked, particularly by the younger metallurgists.

Tin Price Limits

According to reports from La Paz, Bolivia, tin-producing countries might well withdraw from the International Tin Council and form a "pool" of their own, if, by February 14 next year the Council did not agree to fix tin price limits at a minimum of £800, and a maximum of £1,000 per ton. This is reported to have been disclosed in La Paz by Dr. Guillermo Bedregal Gutierrez, President of Comibol, who recently returned from London.

Electric Hoists Order

Four 10-ton 16 in. lift hoists have been ordered by Guest Keen Iron and Steel Company Limited from **Matterson Limited.** The hoists, valued at approximately £3,500, will be used by Guest Keen for furnace relining duties at their East Moors, Cardiff, plant, where four blast furnaces are in operation. The hoists will be delivered next February, and the first of the furnaces to be relined with their help will be started on at the beginning of March.

New Branch Factory

At the end of this month **Roto-Finish Limited** will open a branch factory at the new Cumbernauld Estate, which is situate some 12 miles from Glasgow. The floor area of the new factory is 3,000 ft² and the company's barrel and vibrafinishing machines will be installed for demonstration and for sample processing purposes.

The factory will hold stocks of the company's materials in order to give immediate service to industry in the Scottish area, and it is also possible that initially there may be spare capacity available for contract work.

Chromating Process

To fulfil a requirement for a chromating process suitable for large scale production, the **Pyrene Company Limited** have introduced the Bonderite "250" series. This series is designed to operate at room temperature and to produce on hot dipped galvanized steel, electro-zinc plated steel or zinc-based alloys, chromate coatings which give considerable corrosion protection. The coatings also form an excellent surface for subsequent painting. The range at present consists of three processes:

Bonderite "250" is specifically formu-

MEN and Metals

Resigning his present directorships in order to join the board of Davy-Ashmore as technical director on December 4 next, **Mr. G. B. R. Feilden** will be based at the group's London headquarters, and will also be joining the boards of the principal operating companies of Davy-Ashmore.

It has been announced that **Mr. Geoffrey S. Palmer,** A.C.A., has joined James Booth Aluminium Limited as chief accountant.

The Council for Scientific and Industrial Research has appointed **Dr. John Vernon Dunworth,** C.B.E., as deputy director, National Physical Laboratory, D.S.I.R., in succession to **Dr. G. Macfarlane,** who is shortly to take up the appointment of Director of the Royal Radar Establishment at Malvern. Dr. Dunworth is at present deputy director of the Atomic Energy Establishment at Winfrith.

An announcement from the Brockhouse Organization states that **Mr. S. C. Lloyd,** of Brockhouse Trading Facilities Ltd., will leave for a tour of Greece and Yugoslavia.

Having been chairman of the Vitreous Enamel Development Council since its formation in 1957, **Mr. S. W. Vickery,** managing director of Ferro Enamels Limited, has resigned. His successor is **Mr. N. F. Parker,** managing director of Stewart and Gray Limited. Mr. Vickery will continue to serve as a director of the Council.

To mark his 45 years of service with the group, **Mr. Cyril M. Cohen,** chairman and managing director of the George Cohen 600 Group Limited, was recently presented by the group's employees with a silver and enamel cigarette box. With this gift was a commemorative volume containing the names of the 1,400 subscribers, and also a cheque which will be sent to a charity personally selected by the chairman.

Resigning from the board of Greaves and Thomas, **Mr. N. G. Foulkes** has joined the International Nickel Company (Mond) Limited as assistant to the managing director.

At the annual meeting of the Organization of European Aluminium-Smelters, recently held in Brussels, **Dr. Arthur Wiederkehr,** of Switzerland, was re-elected President; **Dr. Julius Jakobi** (United Kingdom) and **Dr. Joachim Seibel** (Germany) remained Vice-Presidents.

It is announced that **Mr. John P. Evans** has been appointed manager of the market research department of British Insulated Callender's Cables Limited, following the retirement through ill-health of **Mr. J. R. Halliday.**

lated to produce a colourless coating with reasonable corrosion resistance, that would be particularly useful for preventing "white rusting" of articles during storage, and in other circumstances where a coloured film is considered undesirable.

Bonderite "251" also produces colourless coatings but with improved corrosion resistance. When submitted to salt spray tests this process showed a considerable increase in corrosion resistance over other colourless chromate coatings.

Bonderite "255" produces a heavier yellow-coloured chromate film with the high corrosion resistance associated with coatings of this colour.

Laboratory Equipment

For the first time the new Griffin-Grundy all-metal laboratory furniture is to be shown at the Building Exhibition being held at Olympia this month by **Griffin and George (Laboratory Construction) Ltd.** This new furniture has been designed to provide improved metal furniture at a lower price and to be packed easily and economically in "knock-down" form for export.

It is the result of continued consumer research work by Grundy Equipment Ltd. and the Griffin and George group into the requirements of industrial, educational and medical laboratories and workshops. It is stated that the new furniture has improved corrosion resistance and completely rigid construction; doors, catches and other close-mating parts are already assembled in frames so that the final assembly may be carried out by semi-skilled labour easily and quickly. It is also fire-resistant.

Non-Ferrous Metals in Uganda

According to the annual report of the Mines Department for the year ended December 31, 1960, that year was notable for further expansion in the production of copper and beryl in Uganda.

The Kilembe mines increased mining and milling rates, it said, enabling the Jinja smelter to produce a record 14,515 tons of blister copper for the year. The amount of blister copper exported was 14,712 tons, valued at £3,465,000, compared with 11,799 tons, valued at £2,711,488, in 1959.

On beryl production, the report said that 419 tons were produced last year against 209 tons in 1959. This reflected the activity and success of detailed prospecting in new and old workings in the Ankole district.

Production of wolfram was resumed, and six mines were operating by the end of the year. Tin production further declined and there was a decrease in the number of current titles. The report said that the total production of all minerals, including cement, was valued at £4,517,411.

Union Carbide on Show

Occupying stand number 5 in the Foundry Section of the Sheffield Industrial Exhibition, to be held next week, **Union Carbide Ltd.**, Alloys Division, will display many of the products they supply to the foundry industry, backed by exhibits from companies using Union Carbide ferro-alloys and metals. Included in the display will be a cylinder block as used in the famous "E" type and the new Mark X Jaguars, and a Centurion Tank brake drum.

The new "One Ton Pack" for ferro-alloy briquettes will, with the other bricquette packs, illustrate the ease of stock control and handling with this form of packaging.

News from Birmingham

Unemployment in Birmingham has increased in a month from 10,609 to 12,810, raising the percentage rate from 1·6 to 1·9. In Coventry — an area suffering worst from a major motor dispute—the total has gone up to 9,525, or from 3·7 to 5 per cent. Unfortunately, there is still no sign of this dispute ending. For the first time since last Spring the unemployment total in the wider area of the Midlands now outnumbers the vacancies, so that while the unemployment register increased from 32,109 to 39,286, vacancies fell from 33,079 to 28,644. There are signs that many firms have a smaller demand for unskilled labour.

It is encouraging to find that orders for export are rising in the machine tool industry. On the other hand, home orders are declining. Capacity exceeds demand in most branches of the iron and steel trade. Fabricators, however, still have a great deal of work, much of it for extensions to existing steelworks. The re-rolling trade can cope comfortably with the market for small bars and sections. There is a brisk market for reinforcing rods and bars. Some blast furnaces are idle, but there is no difficulty in satisfying all requirements for pig iron.

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Harco Castings Limited (702740), 2 Grove Farm, High Road, Chadwell Heath, Essex. Registered September 8, 1961. To carry on the business of metal founders, etc. Nominal capital, £1,000 in £1 shares. Directors: Stanley L. Fuller and Leonard A. Harding.

J. & D. Spinnings Limited (702852), 178 Bromsgrove Street, Birmingham, 5. Registered September 11, 1961. To carry on the business of metal spinners, press-workers, etc. Nominal capital, £100 in £1 shares. Directors: Reginald R. Barnes and William H. Jones.

Waterloo Scrap Metal Company Ltd. (702761), Lodge Yard, Waterloo Road, Burnley. Registered September 8, 1961. Nominal capital, £1,000 in £1 shares. Directors: Cyril Hanson and James Durkin.

Brynmawr Metals Limited (702991), 4 Catholic Road, Brynmawr, Brecs. Registered September 12, 1961. To carry on the business of metal and scrap metal merchants, etc. Nominal capital, £1,000 in £1 shares. Directors: John Thompson and Henry Thompson.

Metal Fabrication (Properties) Limited (703152), 26 Victoria Street, Luton. Registered September 13, 1961. To acquire property, etc. Nominal capital, £10,000 in £1 shares. Directors: Harry C. Fletcher and Catherine D. Fletcher.

John Hampson Limited (703569), 32 Lakeside Avenue, Bolton. Registered September 19, 1961. To carry on the business of scrap metal merchants, etc. Nominal capital, £2,000 in £1 shares. Directors: John Hampson, David Hampson, Mrs. Lily Hampson and John Hampson junr.

Trade Publications

Plant and Equipment.—The Power-Gas Corporation Limited, Parkfield Works, Stockton-on-Tees.

A useful brochure in English, French, German and Spanish provides useful information concerning the chemical, gas, petroleum and general engineering activities and plant provided by this company. Some excellent photographs accompany the details.

Cellobond Polyester Story.—British Resin Products Limited, Devonshire House, Piccadilly, London, W.1.

Increasing industrial use of polyester/glass as a material of construction is well illustrated in this new 24-page booklet. After an introductory section on the manufacture, properties and use of Cellobond polyester resins, the needs of the motor industry, commercial vehicle building, ships and boats, building and construction, chemical plant, electrical equipment, railways, caravans, and shop-fitting and furnishings, are described and the methods by which these needs are met. There are many excellent illustrations.

Die Sets.—The Desoutter Group, The Hyde, Hendon, London, N.W.9.

The die set division, where production is concentrated entirely on standardized die sets in a very wide range of types and sizes, is one of five factories within the Desoutter group of companies. Over 2,000 different variations of their standard models are offered, and in the new catalogue just issued by the group, details and many illustrations are given of these die sets. A considerable amount of statistical data are also included.

High-Frequency Industrial Processes.—New Rochelle Thermatool Corporation, 85 Beechwood Avenue, New Rochelle, N.Y., U.S.A.

An interesting 40-page booklet describes new developments in the use and application of high frequency, and in particular the "Thermatool" system of high frequency, contact resistance heating of metals for the forge welding of such widely different stock as aluminium, cold and hot rolled steel, zirconium, brass, copper, titanium, stainless steel, etc. Some details, diagrams and statistics of this system are provided, together with many excellent illustrations.

Mould and Die Parts.—Diemould Service Company Limited, London Road, High Wycombe, Bucks.

A useful and well-illustrated brochure describes the standardized mould and die parts which this company provides as a service to the pressure die-casting and plastic moulding industries. Statistics and diagrams are included in the brochure of the wide range of products described including ejector pins, guide pillars and bushes, pouring sleeves and plunger tips, toggle units etc.

Metal Market News

LAST week saw a series of rather uninteresting markets, but tin made a good showing, scoring a useful advance. Copper remained steady but closed rather lower on balance in spite of another 2,000 tons stock reduction. The trouble with copper, as indeed in other directions as well, is that demand is not as good as it should be at this time of the year. Nevertheless, it is reported that consumers who are arranging period supply contracts for next year are basing on a tonnage certainly no less than what they asked for twelve months ago. In all the circumstances this does not seem an unreasonable course to pursue for, following the present marked lull in activity, it is not unreasonable to expect a revival in the spring of next year. In the States, business seems to be quite good, but it may be doubted whether there is much room for further improvement. The price is fully steady at 31 cents, both producers and custom smelters holding out for this figure. Comex has been behaving in a somewhat erratic fashion of late, but broadly speaking the course of the quotation there follows the London market. There are, of course, differences between the methods of dealing in New York and London, but there can be no doubt that what happens at either centre influences the other.

Strangely enough, the continuing fall in the L.M.E. stocks in official warehouses has not led to any contraction in the contango. On the contrary, the settlement price at the end of the week was £1 below three months, which compared with a backwardation of 5s. a week earlier. Trading in standard copper was not very brisk but the turnover added up to 10,850 tons, of which a fair proportion was represented by carries. At the close on Friday afternoon cash stood at £229 5s. 0d. and three months at £230, cash showing a loss of 20s. and three months of 5s. The fall in L.M.E. stocks reported at the beginning of the week was 2,035 tons, bringing the revised total down to 16,150 tons. As to the other metals, tin reserves fell by 202 tons to 4,555 tons, while lead was up by 25 tons to 10,609 tons. In zinc, an increase of 780 tons brought the total up to 10,402 tons.

Both lead and zinc were depressed markets, and the price of the former fell in midweek to £60 17s. 6d. cash and £62 2s. 6d. three months, the lowest level seen for some fifteen years. This proved to be the bottom for the week, and the close was £62 cash and £63 three months. The turnover was 9,350 tons and losses on balance amounted to 30s. in three months and 25s. in cash. About 5,250 tons of zinc changed hands, cash being 25s. down at £71 5s. 0d. and three months 30s. lower at £72. In tin, the contango narrowed to £1, cash closing £12 up at £955 and three months £8 better at £956. The turnover was 1,625 tons. Demand for tin has improved and there are prospects that this will continue for a while. American consumers are also showing more interest.

New York

At the week-end copper futures were irregular in active dealings. The nearby December position was slightly lower, other positions were steady. In physical copper, dealer sources indicated quiet conditions in domestic and export copper. Leading custom smelters noted fair sales for November while producers reported fair to active November business. One leading producer said November sales were going "exceptionally well". Scrap copper was unchanged. Tin was quiet, steady. Spot was offered at 121¾ cents/lb., November at 121½, December at 121⅛, and January at 121 cents/lb. Lead was quiet. Prime western zinc was in fair activity. Special high grade zinc sales were modest.

Tin consumption in the United States increased by 18 per cent in August 1961 compared with July, according to the Bureau of Mines, U.S. Department of the Interior. Tin used during the month totalled 7,210 long tons, comprised of 4,570 tons of primary pig tin and 2,640 of secondary and imported tin-base alloys. July consumption of tin was 6,090 tons, 3,920 of primary and 2,170 of secondary and imported tin-base alloys. Total United States industry tin stocks increased from 39,100 long tons (revised) on August 1 to 39,730 tons on August 31. Excluding tin in process and afloat, stocks in the United States stood at 23,080 tons on August 31, 1961.

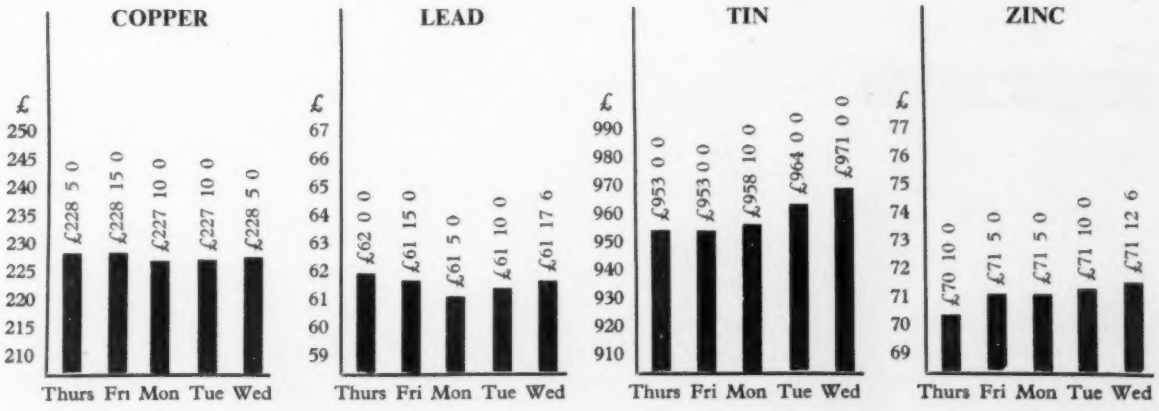
Paris

Narrow fluctuations either way characterized the scrap market last week. In slow dealings, aluminium and copper were inclined to sag as buying interest remained negligible. A soft undertone was also apparent for lead and zinc, reflecting poor foreign advices. On the other hand, brass prices were generally higher on a small demand.

Recent news from Paris states that the French subsidiary of the Aluminium Company of Canada has changed its name from "Alcan Aluminium de France" to "Aluminium Alcan de France".

London Metal Exchange

Thursday 26 October to Wednesday 1 November 1961



C

NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 1/11/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	„	237	10	0
Antimony Metal 99%	„	230	0	0
Antimony Oxide Commercial	„	194	10	0
Antimony White Oxide	„	212	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		11	6
Calcium	„	2	0	0
Cerium 99%	„	15	0	0
Chromium	„		6	11
Cobalt	„		12	0
Columbite	per unit		8	10
Copper H.C. Electro	ton	228	5	0
Fire Refined 99·70%	„	227	0	0
Fire Refined 99·50%	„	226	0	0

		£	s.	d.
Copper Sulphate	ton	78	0	0
Germanium	grm.		—	
Gold	oz.	12	10	1½
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	61	17	6
Magnesium Ingots	lb.			
99·8%	„		2	2½
99·9+%	„		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		5	6
Alloy Ingot. AZ91X		1	11¾-2	1¼
Manganese Metal	ton	280	0	0
Mercury	flask	60	0	0
Molybdenum	lb.	1	15	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	„		5	11
Osmium	oz.	20	0	0
Osmiridium	„		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	„	30	5	0
Rhodium	„	46	0	0
Ruthenium	„	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		6	8
Tellurium Sticks	lb.	2	0	0
Tin	ton	971	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	72	0	0
Dust 95/97%	„	115	5	0
Dust 98/99%	„	121	5	0
Granulated 99+%	„	97	0	0
Granulated 99·99+%	„	108	11	3

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 1/11/61

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 ton		nom.	
B.S. 1490 L.M.6 „		„	
B.S. 1490 L.M.7 „		„	
B.S. 1490 L.M.8 „		„	
B.S. 1490 L.M.9 „		„	
B.S. 1490 L.M.10 „		„	
B.S. 1490 L.M.11 „		„	
B.S. 1490 L.M.12 „		„	
B.S. 1490 L.M.13 „		„	
B.S. 1490 L.M.14 „		„	
B.S. 1490 L.M.15 „		„	
B.S. 1490 L.M.16 „		„	
B.S. 1490 L.M.18 „		„	
B.S. 1490 L.M.22 „		„	
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 ton	150	0	0
B.S. 1490 L.M.2 „	150	0	0
B.S. 1490 L.M.4 „	159	0	0
B.S. 1490 L.M.6 „	176	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ton	236	0	0
BSS 1400 AB.2 „	243	0	0

		£	s.	d.
***Brass**				
BSS 1400-B3 SCB2	ton	174	0	0
BSS 249	„	171	0	0
***Gunmetal**				
B.S. 1400: LG2 d/d	„	208	0	0
B.S. 1400: LG3 d/d	„	219	0	0
B.S. 1400: GI 1½ Pb d/d	„	278	0	0
B.S. 1400: GI ½ Pb d/d	„	293	0	0
***Manganese Bronze**				
BSS 1400 HTB1	„	189	0	0
BSS 1400 HTB2	„	210	0	0
BSS 1400 HTB3	„	226	0	0
Nickel Silver				
Casting Quality 12%	„	255	0	0
„ „ 16%	„	265	0	0
„ „ 18%	„	310	0	0
***Phosphor Bronze**				
B.S.1400P.B.1.(A.I.D. released)	„	311	0	0
B.S. 1400 L.P.B.1	„	233	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ton	254	0	0
15% „	257	0	0
Phosphor Tin			
5% „	1020	0	0
Silicon Bronze			
BSS 1400-SB1 „	270	0	0
Solder, soft, BSS 219			
Grade C Tinmans „	429	10	0
Grade D Plumbers „	339	5	0
Grade M „	474	10	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „		—	
Zinc Alloys			
BSS 1004 Alloy A ton	102	1	2
BSS 1004 Alloy B „	106	1	3
Sodium-Zinc lb.		2	6

SCRAP METALS

Merchants' average buying prices delivered, per ton, 31/10/61

Aluminium	£
New Cuttings	134
Old Rolled	100
Segregated Turnings	72
Brass	
Cuttings	154
Rod Ends	141
Heavy Yellow	131
Light	126
Rolled	142
Collected Scrap	128
Turnings	133

Copper	£
Wire	197
Firebox, cut up	195
Heavy	194
Light	191
Cuttings	202
Turnings	187
Braziery	161
Gunmetal	£
Gear Wheels	194
Admiralty	194
Commercial	176
Turnings	171

Lead	£
Scrap	53
Nickel	
Cuttings	—
Anodes	590
Phosphor Bronze	
Scrap	176
Turnings	171
Zinc	
Remelted	64
Cuttings	54
Old Zinc	35

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products

Aluminium	£	s.	d.
Sheet 10 S.W.G. lb.		2	10½
Sheet 18 S.W.G. ,,		3	0½
Sheet 24 S.W.G. ,,		3	3½
Strip 10 S.W.G. ,,		2	10½
Strip 18 S.W.G. ,,		2	11½
Strip 24 S.W.G. ,,		3	1
Circles 22 S.W.G. ,,		3	4½
Circles 18 S.W.G. ,,		3	3½
Circles 12 S.W.G. ,,		3	2½
Plate as rolled ,,		2	10
Sections ,,		3	4
Wire 10 S.W.G. ,,		3	1½
Tubes 1 in. o.d. 16 S.W.G. ,,		4	4
Aluminium Alloys			
BS 1470. HS19W.			
Sheet 10 S.W.G. ,,		3	3
Sheet 18 S.W.G. ,,		3	5½
Sheet 24 S.W.G. ,,		4	1
Strip 10 S.W.G. ,,		3	3
Strip 18 S.W.G. ,,		3	4½
Strip 24 S.W.G. ,,		4	0½
BS1477. HP30M.			
Plate as rolled ,,		3	1
BS1470. HC15WP.			
Sheet 10 S.W.G. ,,		4	3
Sheet 18 S.W.G. ,,		4	8½
Sheet 24 S.W.G. ,,		5	8½
Strip 10 S.W.G. ,,		4	4
Strip 18 S.W.G. ,,		4	8½
Strip 24 S.W.G. ,,		5	4½

Aluminium Alloys—cont.	£	s.	d.
BS1477. HPC15WP. Plate heat treated .... lb.		3	10½
BS1475. HG19W. Wire 10 S.W.G. ,,		4	2
BS1471. HT19WP. Tubes 1 in. o.d. 16 S.W.G. ,,		5	5
BS1476. HE19WP. Sections ,,		3	4
Split tube 19 S.W.G. (½″) ,,		4	2
20 S.W.G. (⅜″) ,,		3	11
21 S.W.G. (⅜″) ,,		4	1
22 S.W.G. (¼″) ,,		4	11
Welded tube 14 to 20 S.W.G. (sizes ½″ to 1½″) ,,	3/10½ to 5/8½		
Brass			
Tubes lb.		1	9¾
Brazed Tubes ,,		3	1¾
Drawn Strip Sections ,,		3	1¾
Sheet ton	195	10	0
Strip ,,	195	10	0
Extruded Bar lb.		2	0
Condenser Plate (Yellow Metal) ton	184	0	0
Condenser Plate (Naval Brass) ,,	198	0	0
Wire lb.		2	8½

Beryllium Copper	£	s.	d.
Strip lb.	1	4	11
Rod ,,	1	1	6
Wire ,,	1	4	9
Copper			
Tubes lb.		2	3⅛
Sheet ton	263	0	0
Strip ,,	263	0	0
H.C. Wire ,,	280	5	0
Cupro Nickel			
Tubes 70/30 lb.		3	8¾
Lead			
Pipes (London) ton	103	5	0
Sheet (London) ,,	101	0	0
Tellurium Lead ,,	£6 extra		
Nickel Silver			
Sheet and Strip 10% lb.		3	11¾
Wire 10% ,,		4	4¾
Phosphor Bronze			
Wire ,,		4	2½
Titanium (1,000 lb. lots)			
Billet 4½″ to 18″ dia. lb.	47/-		48/-
Rod ¼″ to 4″ dia. ,,	85/-		53/-
Wire ·036″·232″ dia. ,,	159/-		99/-
Strip ·001″ to ·048″ ,,	350/-		68/-
Sheet 8′×2′. 20 gauge ,,	73/-		
Tube, representative average gauge ,,	198/-		
Extrusions ,,	90/-		
Zinc			
Sheet ton	109	10	0
Strip ,,	nom.		

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium	fr/kg	£/ton
Copper: electrolytic	31.75	232 1
Tin	132.55	968 16

Canada	c/lb	£/ton
Aluminium	24.00	194 8
Copper: electrolytic	30.00	243 0
Lead	10.50	81 0
Nickel	70.00	567 0
Zinc: Prime western	12.00	97 4
High grade 99.95	12.60	102 1
High grade 99.99	13.00	105 6

France	fr/kg	£/ton
Aluminium	2.43	179 11
Antimony 99·0	2.80	206 18
Cadmium	16.25	1,200 17
Copper: electrolytic	3.20	236 9
Lead	.93	68 14
Nickel	9.00	665 2
Tin	13.59	1,004 6
Zinc: Thermic	1.07	79 1
Zinc: electrolytic	1.15	85 0
Scrap		
Copper: electrolytic	2.82	208 7
Heavy copper	2.82	208 7
No. 1 copper wire	2.75	203 4
Brass rod ends	2.15	158 17
Zinc castings	.85	62 16
Lead	.85	62 16
Aluminium	1.80	133 0

Italy	lire/kg	£/ton
Aluminium	370	216 1
Antimony 99·0	475	277 8
Copper: wire bars 99·9	440	256 19
Lead	162	94 12
Nickel	1,300	805 14
Tin	1,820	1,062 17
Zinc: electrolytic	172	100 8
Scrap		
Aluminium soft sheet clippings (new)	295	172 5
Lead, soft, first quality	135	78 16
Lead, battery plates	75	43 16
Copper, first grade	365	213 3
Bronze, commercial gunmetal	420	245 7
Brass: heavy	270	157 13
Brass: light	255	148 18
Brass, bar turnings	265	154 15
Old zinc	98	57 4

Switzerland	fr/kg	£/ton
Aluminium	2.50	210 5
Copper: electrolytic	2.82	237 3
Lead	.80	67 5
Nickel	7.70	647 11
Tin	11.65	979 15
Zinc: High grade 99.99	.99	83 5

Japan	Yen per metric ton
Scrap	
Copper: electrolytic	280,000
Copper wire No. 1	250,000
Copper wire No. 2	240,000
Heavy copper	234,000
Light copper	226,000
Brass, new cuttings	190,000
Red brass scrap	218,000

West Germany *Scrap*	D-marks per 100 kilos	£/ton
Used copper wire	220	200 8
Heavy copper	216	196 15
Light copper	190	173 1
Heavy brass	145	132 1
Light brass	110	100 5
Soft lead	50	45 11
Zinc	50	45 11
Used aluminium unsorted	90	82 0

United States	c/lb	£/ton
Aluminium	24.00	191 5
Antimony 99·0	32.50	259 0
Cadmium	160.00	1,275 4
Copper: electrolytic	31.00	247 10
Lead	11.00	87 13
Nickel	81.25	647 11
Tin	121.75	970 6
Zinc: electrolytic	12.50	99 12

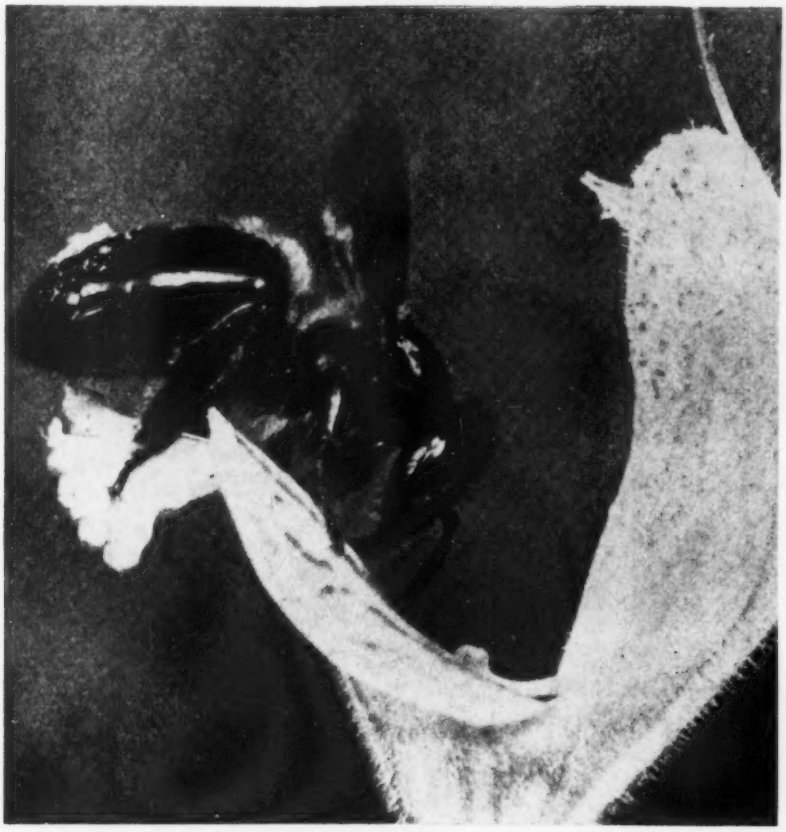
THE STOCK EXCHANGE

Conditions Rather Quiet

ISSUED CAPITAL *	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 30 OCTOBER	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	28/6		11	9	7 14 6	33/9	26/3	35/-	26/6
400,000	2/-	Anti-Attrition Metal	1/3		NIL	4	NIL	1/3¾	0/9	1/6	0/9
43,133,663	Stk. (£1)	Associated Electrical Industries ...	29/6	—9d.	15	15	10 3 3	54/10½	28/3	67/3	38/3
3,895,963	1	Birfield	62/-	+6d.	10	15‡	3 4 6	78/9	45/-	51/3	29/-
4,795,000	1	Birmid Industries	68/6	—6d.	20	20	5 16 9	103/-	68/3	74/9	56/-
8,445,516	Stk. (10/-)	Birmingham Small Arms	19/9	+6d.	17½QT	12½	5 18 3	36/10½	19/3	30/6	18/3
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	12/6		5	5	8 0 0	14/6	12/3	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	15/6		6	6	7 14 9	17/6	15/4½	20/-	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	16/3		6	6	7 7 9	18/-	15/3	21/1½	17/7½
21,737,634	Stk. (£1)	British Insulated Callender's Cables	55/3		13½	13½	4 17 9	62/3	49/-	61/4½	47/-
30,683,348	5/-	British Oxygen Co. Ltd., Ord. ...	16/9	+1/3	16D	16	3 10 3	28/4½	14/9	35/-	19/10½
1,200 000	Stk (5/-)	Canning (W.) & Co.	14/-xd	—1½d.	15¾	25+*2½C‡	5 12 0	20/9	13/7½	19/9	13/7½
60,484	1/-	Carr (Chas.)	1/-		NIL	12½	—	1/7½	10½d.	2/3	1/-
550 000	1	Clifford (Chas.) Ltd.	29/-		12	10	8 5 6	31/-	26/-	35/-	28/9
45,000	1	Ditto Cum. Pref. 6%	15/-		6	6	8 0 0	15/3	15/-	16/-	15/10½
1,166,000	Stk. (2/-)	Clifford Components V	7/9	—3d.	25*2½C	25*2½C	6 9 0	10/1½	7/3	11/9	6/10½
300,000	2/-	Coley Metals	2/9		15	15	10 18 3	4/5½	2/9	5/-	3/4½
10,185,696	1	Cons. Zinc Corp.†	59/3		20	15	6 15 0	81/6	58/6	80/9	59/6
5,399,056	5/-	Davy-Ashmore	30/-	—2/-	27½	22½	4 11 3	44/6	29/6	147/3	99/6
8,995,011	5/-	Delta Metal	20/-		20	17½	5 0 0	27/7½	19/-	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	38/-	+3d.	15	15	7 18 0	52/3	36/6	56/9	45/-
1,155,000	1	Evered & Co.	42/9		10	10φB	4 13 5	45/9	42/6	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	25/3		10	10	7 18 6	39/6	24/3	47/9	29/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	48/9	—9d.	25	20	5 2 6	65/-	42/9	52/6	40/-
937,500	5/-	Glacier Metal Co. Ltd.	16/3	—6d.	15	13	4 12 3	21/1½	13/9	16/1½	11/1½
2,750,000	5/-	Glynwed Tubes	23/-	—6d.	22½	25¶	4 17 9	30/3	23/-	27/6	17/-
7,228,065	10/-	Goodlass Wall & Lead Industries ...	28/6		15	19L	5 5 3	44/9	28/-	41/9	33/-
696,780	10/-	Greenwood & Batley	14/6		15	30‡	10 7 0	29/6	14/3	33/6	29/1½
792 000	5/-	Harrison (B'ham) Ord.	8/9	—3d.	*10	*20‡	5 4 3	14/6	8/6	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	18/-		7	7	7 15 6	20/4½	18/-	23/6	22/-
1,612,750	5/-	Heenan Group	13/-	—3d.	13	15	5 0 0	17/1½	10/6	13/-	9/10½
266,608,683	Stk. (£1)	Imperial Chemical Industries ...	60/3	+6d.	13¾	11½	4 11 3	81/6	56/3	76/6	54/-
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	15/-	+3d.	5	5	6 13 3	16/-	13/10½	18/-	15/4½
29,196,118	**	International Nickel	139½	—7	$1.60	$1.50	2 0 0	160	104	105	84¾
6,000,000	1	Johnson, Matthey & Co.	70/-		15	12	4 5 9	75/-	57/6	67/6	44/9
600,000	10/-	Keith, Blackman	17/6		17½	17½E	10 0 0	21/6	16/6	32/6	17/6
320,000	4/-	London Aluminium	11/3	—3d.	13	12	4 16 3	15/-	8/6	12/6	7/10½
2,667,542	1	McKechnie Bros. A Ord.	32/-	—6d.	11¾K	17½	7 7 6	53/3	32/-	69/3	55/-
1,108,268	5/-	Manganese Bronze & Brass	9/9xd	—1/-	20¾	20¾	11 0 0	18/6	10/-	18/6	13/4½
50,628	6/-	Ditto (7½% N.C. Pref.)	5/3		7½	7½	8 10 6	6/-	5/-	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	75/6	—1/-	12	12M	3 3 9	100/9	68/3	84/3	61/-
415,760	Stk. (2/-)	Metal Traders	7/6		50	50	13 6 9	8/9	6/9	10/9	7/1½
240,000	1	Mint (The) Birmingham	33/9		15G	12½	5 18 3	35/9	24/-	39/-	33/6
80,000	5	Ditto Pref. 6%	71/-	—6d.	6	6	8 9 0	77/6	71/-	80/-	75/-
274,152	1/-	Minworth Metals	5/-	—3d.	30	30S	6 0 0	6/3	4/6¾	5/2½	3/10½
5,187,938	Stk. (£1)	Morgan Crucible A	57/6	—1/3	14	13	4 17 6	71/3	53/4½	63/-	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	15/6	+1/-	5½	5½	7 2 0	17/-	13/10½	18/9	15/9
3,850,000	Stk. (£1)	Murex	38/-	+6d.	13	22½J	6 16 9	52/-	36/9	45/-	35/3
585,000	5/-	Ratcliffs (Great Bridge) Ord. ...	15/6xd		10	10R	3 4 6	16/6	15/6	17/-	14/9
1,064,880	10/-	Sanderson Kayser	33/-	—2/-	17½	35‡	5 6 0	41/3	29/-	40/3	27/7½
3,400,500	Stk. (5/-)	Serck	13/9xd	—3d.	12½	12½	4 11 0	19/3	13/9	25/6	15/3
212,384	5/-	Stedall & Co.	7/6	—3d.	15	15	10 0 0	10/3	7/3	10/3	6/3
8,035,372	Stk. (£1)	Stone-Platt Industries	43/-xd	—4/6	16	15	7 8 9	67/-	39/6	64/4½	52/3
2,928 963	Stk. (£1)	Ditto 5½% Cum. Pref.	15/6	+6d.	5½	5½	7 2 0	18/-	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	60/6	+3/-	14	20	4 12 6	85/6	54/-	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	26/-	—6d.	10	10	7 13 9	38/3	25/9	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	13/-		5	5	7 13 9	15/-	12/4½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	19/6	+1/-	*5	*5	7 12 6A	21/1½	18/-	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord	66/9xd		13¾	13¾	4 2 6	84/6	64/6	94/-	63/-
7,109,424	Stk. (£1)	Westinghouse Brake	24/9	—9d.	11	10	8 17 9	46/3	24/6	60/6	37/6
323,773	2/-	Wolverhampton Die-Casting ...	7/9	—3d.	35	30	9 0 9	13/4½	7/9	13/10½	8/1½
591,000	5/-	Wolverhampton Metal	20/-	—1/-	32½	32½	8 2 6	30/-	20/-	39/9	23/9
156,930	2/6	Wright, Bindley & Gell	4/3		15	20‡	8 16 6	4/9	3/7½	4/6	2/10½
124,140	1	Ditto Cum. Pref. 6%	12/9		6	6	9 8 3	13/7½	12/9	15/-	13/6
150.000	1/-	Zinc Alloy Rust Proof	4/3		40	30	9 8 3	5/6	4/3	5/4½	4/-

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡and 100% capitalized issue. *The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. φ and 6½% from Capital Profits. B and 50% capitalized issue. G and 50% capitalized issue. F and special 5% tax free dividend and 50% capitalized issue. ¶and 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. Q also 1/- special tax free dividend and 50% capitalized issue. T Per £1 unit. K 50% capitalized Issue allowed for. S and 50% capitalized issue. V incorporating Clifford Covering.

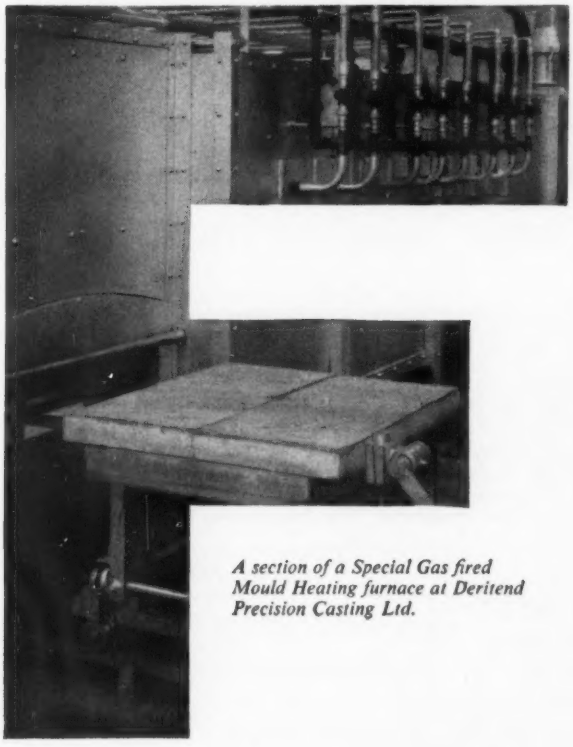
The Thomas Bolton Capital has been acquired by British Insulated Callender's Cables.



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A section of a Special Gas fired Mould Heating furnace at Deritend Precision Casting Ltd.

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There's big savings in terms of dependability and easy maintenance when Franklin are called in on that furnace installation. Long experience in the supply of standard, and the design of special furnaces mean the snags are quickly ironed out. Furnaces fired by 'Dine' Burners give easy maintenance and fuel economy, that's why more and more well-known Companies are now counted as customers.
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ENGLAND'S MOST EFFICIENT ZINC MELTER

AS USED BY LEADING ZINC DIE-CASTERS



Specially designed range of Zinc Melting Furnaces, tangentially fired by single forced draught gas or oil burner. Fitted special type flanged heat-resisting iron crucible, and if required, arranged with automatic temperature control to ensure exacting results at all times, without the use of skilled labour. Illustration shows gas fired Furnace one-ton Zinc capacity, Type F.2. Automatically gas fired. Capacities from 100 lb. up to 4,000 lb. Central or Lip Axis Tilting arranged when required, for the feeding of further bale-outs, or direct by shute into die-casting machines. Also manufacturers of Furnaces for Aluminium, Brass and all non-ferrous metals.



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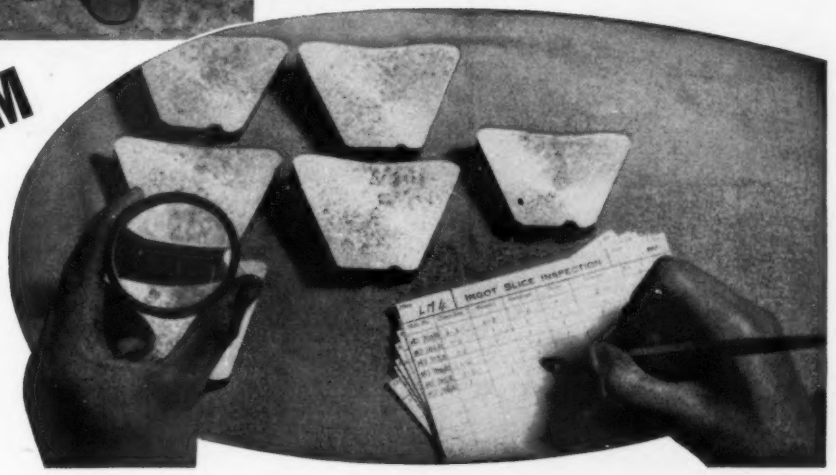
"Members of the National Association of Non-Ferrous Scrap Metal Merchants."

METAL MERCHANTS



QUALITY...

UNIFORM



Intensive Research and Quality Control ensure that you can depend on the uniformity of

Unceasing research and strict quality control, at all stages of production, ensures that Intal Light Alloy Ingots can always be depended upon. The quality never varies. With over a quarter of a century's experience and progress, Intal maintain all the newest techniques in scientific inspection, and make use of the most advanced instrumentation in ensuring that the Intal high standard of quality is consistently maintained.

INTAL

Light Alloy Ingots

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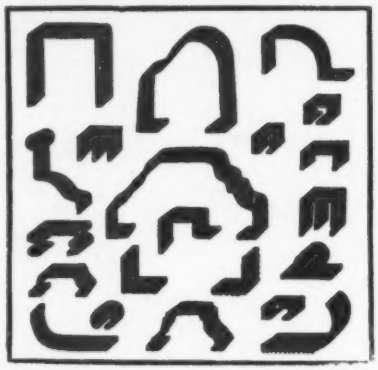
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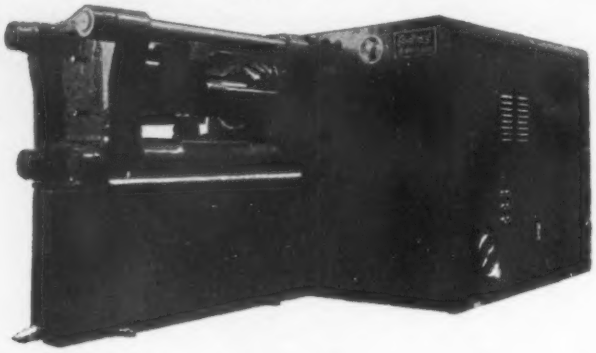
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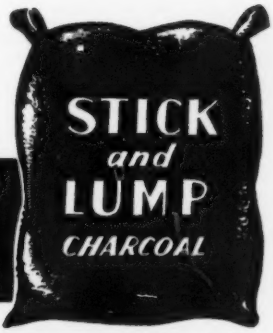
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